ESIGN CONTEST WINNER! BUILD THE WINGLET

48120 March 1994

MODEL AIRPLANE NEWS

THE WORLD'S PREMIER R/C MODELING MAGAZINE

HOW TO'S:

MAKE YOUR OWN MUFFLER

BUILD LEADING-EDGE FLAPS

Bomber Field Big Bird Fly-In

DESIGN LANDING GEAR

MAKE 4-STROKE SMOKE

FULL COVERAGE

SOUTHWEST FAN FLY

- Byron .60 Sukhoi
- U.S. Aircore KnightHawk
- Anabatic Products Anabat Combat Sailplane

$3.50 CANADA $4.50

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MARCH 1994 VOLUME 122, NUMBER 3

MODEL AIRPLANE NEWS

FEATURES

ABOVE: *this scratch-built SR-71 Blackbird, built by Lowell Wexler, appeared at the most recent Southwest Fan Fly. (Photo by Rich Uravitch.)*

ON THE COVER: *George Snider's 1/3-scale Sukhoi tears up the sky at the Bomber Field Big Bird Fly-In. See coverage. (Photo by Dan Parsons.)*

FEATURES

CONSTRUCTION

COLUMNS

COLUMNS

DEPARTMENTS

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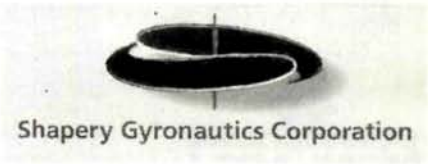
EDITORIAL

TOM ATWOOD

THE GREAT R/C SLOW-FLIGHT DESIGN CONTEST

Co-sponsored by *MODEL AIRPLANE NEWS*, NASA Langley Research Center, the NACA/NASA Alumni Association and Shapery Gyronautics Corporation

MODEL AIRPLANE NEWS



We have exciting news to report on the Great R/C Slow-Flight Design Contest introduced last issue: we have a new co-sponsor and an expanded purse. In addition, a number of important clarifications to the rules are set out below to supplement last month's contest announcement.

Before addressing additional details of the Slow-Flight Design Contest, I would like to take a moment to assure any readers who have been looking forward to our next "traditional" design contest, i.e., one that is open to R/C models of all types, that we do plan to hold more of these in the future.

CASH PRIZES IN EACH OF THREE CLASSES!

INTERNAL COMBUSTION, CLASS A—"Floaters"
1st Prize—$1,000
2nd Prize—$500
3rd Prize—$250

INTERNAL COMBUSTION, CLASS B—"Conventional Aircraft"
1st prize—$1,500
2nd prize—$825
3rd prize—$425

INDOOR ELECTRIC
1st prize—$1,000
2nd prize—$500
3rd prize—$250

NEW CO-SPONSOR RAISES PURSE

We are pleased to report that Shapery Gyronautics Corp.—a company developing vertical takeoff and landing (VTOL) and short takeoff and landing (STOL) designs for commercial and public sector use—has generously increased the purse by $1,000 for the heavy wing-loading internal-combustion engine class (referred to below as Class B—"Conventional Aircraft"). This brings the cash prizes for this class to these levels: first prize—$1,500; second prize—$825; and third prize—$425. We would like to thank Dave Abbe, developer of DAD R/C radio systems and also a vice president of Shapery, for bringing Shapery in as co-sponsor. Dave comments: "Our support for this contest reflects Shapery Gyronautics' ongoing interest in encouraging new ideas and developments that contribute to improved, 21st-century technology, VTOL/STOL capabilities."

CONTEST GUIDELINES

As noted in the last issue, the purpose of the contest is to spur development of practical low-speed flight capability, i.e., to expand the performance envelope of traditional designs and to develop entirely new ones. Two classes of competition were chosen: internal combustion and electric. The internal-combustion class was subdivided into two secondary classes: Class A—"Floaters," with wing loadings of 15 ounces per square foot or lower and Class B—"Conventional Aircraft," with wing loadings of 20 ounces per square foot or greater. The requirement of a total engine displacement of .40 to .50ci was driven by the desire to see aircraft that were large enough to be flown outdoors. The number of engines is optional, e.g., one could use three .15s or a single .45.

The electric class, which we are calling "indoor electric," will hopefully lead to some interesting new possibilities for indoor R/C.

For both the internal combustion classes and the indoor electric class, there are many avenues for exploration: large, high-lift devices; "channel" wings; thrust vectoring tabs; auxiliary fans; telescoping wings; tilt wings; and powered glider/autogyro hybrids, just to name a few.

Again, the contest will run from January 1, '94 to December 31, '94. Entries will be evaluated by a panel comprising NASA design engineers and NACA/NASA alumni (NASA Langley and the NACA/NASA Alumni Association are serving in an advisory capacity only and are not putting up funds for the contest). Each winner will receive both a cash prize and an award certificate signed by NACA/NASA luminaries. Awards will be presented in early '95 at the Virginia Air and Space Center in Hampton, VA.

CLARIFICATION OF RULES

The following notes are intended to answer questions that have arisen since the initial announcement of the contest. Contestants are invited to ask questions if any rules seem vague or ambiguous.

1. Indoor electric class. The plane must be able to fly at least two circuits around the perimeter of a regulation-size (professional) indoor basketball court. It must be able to do a figure-8 within the court, although not necessarily on the same run as the laps. Slow flight will be measured along a 50-foot course that is 15 feet wide. Any number of Ni-Cds or electric motors may be used.

2. Scoring hover. A point system will be used in the internal-combustion

(Continued on page 124)

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AIRWAVES

WRITE TO US! We welcome your comments and suggestions. Letters should be addressed to "Airwaves," **Model Airplane News,** 251 Danbury Road, Wilton, CT 06897. Letters may be edited for clarity and brevity. We regret that, owing to the tremendous numbers of letters we receive, we cannot respond to every one.

ERRATA

In the break between pages 8 and 9 of our January issue, a sentence of a letter by Larry Renger discussing modifications to Cox Black Widow engines was fragmented. It should have read: "Modern Black Widows already have an 0.081 venturi, and that is about as far as you can go and still get fuel draw in maneuvers."

GENTLEMEN, YOU HAVE A RACE

I'm glad to inform you that Unlimited and AT-6 air racing is coming to the Northeast. As you may be aware, Sky Aviation has been involved in giant-scale air racing from day one. We're tired of trekking all the way out to the West Coast to watch West-Coast dominated air races. We think it's time for the eastern fliers to challenge western supremacy. So we decided to act.

Sky Racers in conjunction with the Sanair Racing facility is proud to announce the Sky Racers Grand Prix to be held at Sanair, Montreal, Canada, August 15 to 21, 1994. It will include Unlimited as well as AT-6 classes and, if we have a demand, the new Formula 1 class. We will be using the 1993 GSARA rules; however, the Grand Prix is not a GSARA race.

Sanair is a large car-racing facility just east of Montreal. It includes a world-class drag strip and tri-oval track. For many years it has been the host of the Canadian Grand Nationals. This site offers us the opportunity to put on a topnotch event. Our pilots and support crews will have complete use of our seven-story control tower, including pilots' lounge, meeting rooms and showers. The pits won't be! We have garage space for every team. There's no need for the pilots and crew to be out in the elements while making repairs. Sky Racing has booked the course for the entire summer. Racers can fly the course any time they want; all they have to do is make an appointment.

Since accommodations are always a problem at a race, Sky has booked an entire 280-room hotel with a large conference center (it can accommodate 30,000) for Race Central and a trade fair. For racers who want to ship their aircraft to the race, Sky Racers has a bonded warehouse in Champlain, NY, and will do custom clearance free of charge. For those racers who are driving, we will provide comprehensive instructions that will take all of the hassle out of the Canada/U.S. border. We have seating for 25,000 spectators, and they will be protected by a 20-foot-high cable fence that was designed to keep stray car parts out of the stands. There will be food, drink and all the amenities that a race-goer would expect at a world-class facility.

With New York, New Jersey, Baltimore, Washington, Boston, Chicago, Detroit, Philadelphia and Toledo all within a day's drive (and don't forget that a U.S. dollar is equal to a $1.30 Canadian), your race will be less expensive as well as enjoyable. We want the racers and spectators to bring their families. Montreal is only minutes away and offers an exceptional opportunity for holiday activities. The vicinity includes an amusement park, a wild game park, a casino, boat rides on the St. Lawrence, the old port of Montreal, the Just for Laughs Museum and much more.

Sky Racers promises a hot August week to remember. For advanced tickets, registration, trade-show booths and accommodations, please contact Sky Racers at 1320 Gay Lussac, Suite 106, Boucherville, Quebec, Canada, or phone (514) 449-0142; fax (514) 449-0144.

ALAN STANFORD
Boucherville, P.Q., Canada

You heard it here first, folks! Other giant-scale races planned for this year include the '94 Madera Unlimited R/C Air Race, scheduled for the last week in September—for

information, call (310) 320-8369; the '94 Texas Unlimited Air Races & Air Show, scheduled for May 10 to 15 in Galveston, TX—(713) 391-4799; the Radio Controlled National Championship Air Races, scheduled for June 2 to 5 in Reno, NV—(702) 677-0869; and the AT-6 races to be held at the Aviation Expo, scheduled for August 3 to 7 in Ankeny, IA—(515) 965-9082. Attend any one of these R/C sporting events, and you'll be in for quite a thrill. TA

IN REBUTTAL

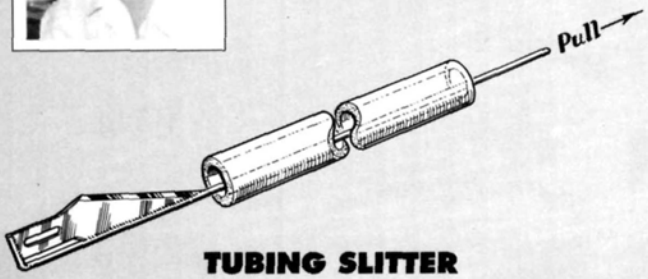
I want to thank *Model Airplane News* for making this space available for rebuttal of the review of "R/C Flight Instruction Videotape Series Vol. 1.1." As the author of this videotape series, I found this review to be very disturbing. The reader of this review is being shortchanged, because the review fails to make any mention of the material at the core of this project. This series unveils a method called the "direction of travel rules." This method outlines how a pilot can accurately determine useful navigational data from his or her aircraft at any given moment during flight. This method has been proven to be very valuable through hundreds of hours of R/C flight instruction time. Once the information has been assimilated by a student pilot, his self-confidence and learning rate dramatically increase, as if he has become a part of the aircraft he is flying! It is a simple, almost obvious concept that, once learned, enhances an R/C flier's control of his aircraft and enjoyment of flying. Many R/C pilots never learn this concept on their own. Many others do. My guess is the reviewer has learned this concept without realizing it and refuses to acknowledge its value to him or anyone else (including the novice), not realizing how much value it truly was to him when he learned it! Riding a bicycle is no big deal once you know how to ride one! Try telling that to someone who just can't get the knack of riding one.

(Continued on page 34)

HINTS & KINKS

JIM NEWMAN

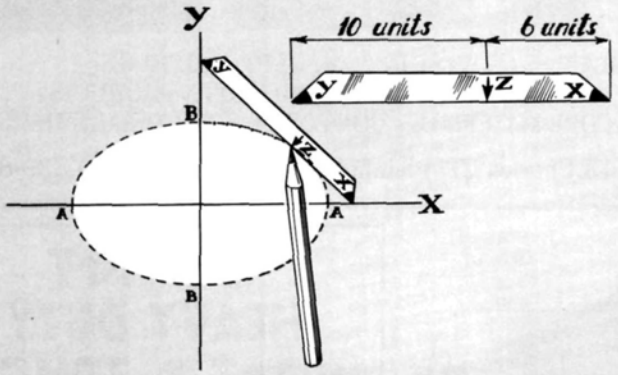
Model Airplane News will give a free one-year subscription (or one-year renewal if you already subscribe) for each idea used in "Hints & Kinks." Send a rough sketch to Jim Newman c/o *Model Airplane News*, 251 Danbury Rd., Wilton, Ct 06897. BE SURE YOUR NAME AND ADDRESS ARE CLEARLY PRINTED ON EACH SKETCH, PHOTO AND NOTE YOU SUBMIT. Because of the number of ideas we receive, we can't acknowledge each one, nor can we return unused material.



TUBING SLITTER

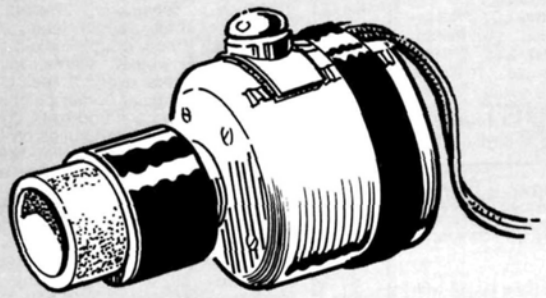
Slit rubber tubing is often used as cockpit edging. To make a slitting tool, use thick CA to glue a no. 11 blade to a piece of 1/16-inch-diameter music wire that's slightly longer than the tubing. Then pull the wire through the tubing for a clean cut.

Les Schjelderup, Coal Valley, IL



ELLIPSES REVISITED

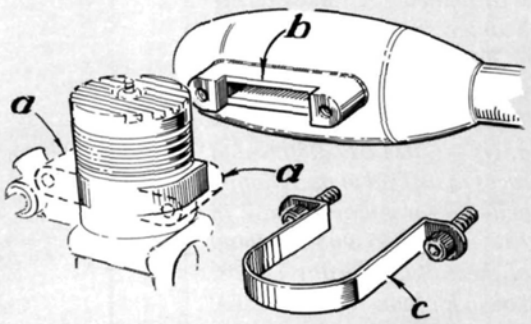
This method for plotting elliptical formers—without pins or strings—is even simpler than the method described in "Hints & Kinks" in our November '93 issue. If, for example, the distance from A to A is 20 units, and the distance from B to B is 12 units, make a cardboard or plastic scale in the proportions of 10 units to 6 units. The corners of the scale marked X and Y are always kept in contact with the X and Y axes while you make pencil dots at the point Z. Join the dots using a French curve and a pencil. ***Jean Hebert, Mougins, France***



COOL ELECTRIC STARTER

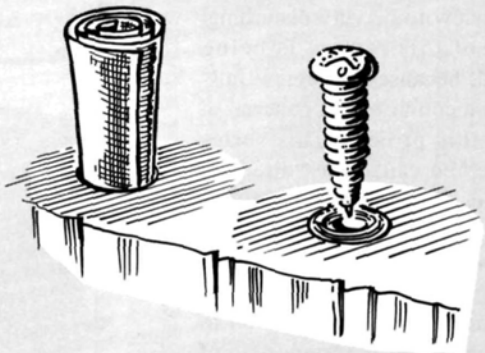
Obtained from the junk yard, this cooling-fan electric motor came from a compact car. Because it turns a large, multi-blade cooling fan, this motor possesses high torque. Using double-sided tape, attach a large push-button switch and tape the leads to the motor. Add battery clips and a new or used starter cup, and you'll have saved quite a few dollars.

Paul Siemons, Wommelgem, Belgium



MUFFLER ATTACHMENT FIX

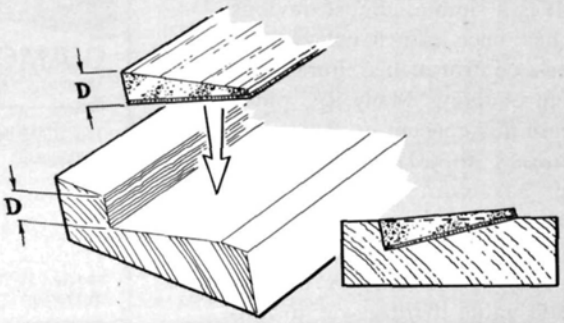
To deal with damaged or stripped muffler-mounting lugs on your engine (a), file them off, then buy a replacement muffler that has a mounting strap (c). The drawing shows an Enya M-200 muffler that has been adapted to fit a Merco. [Note the recess (b) that has been milled or filed in the muffler port to fit over the now-squared exhaust stub.] Seal the mating faces with Robart's High Temp RTV Silicone Gasket Maker. ***Ed Baumgartner, Kempton Park, S. Africa***



STRIP-PROOF SCREW ANCHOR

Force a tightly rolled Sig Easy hinge into a hole of a suitable size until it's flush with the balsa's surface, and then saturate it with thin CA. This hardened "bushing" will accept wood screws without being stripped out. It's great for hatch or cowl fixings that must be removed frequently.

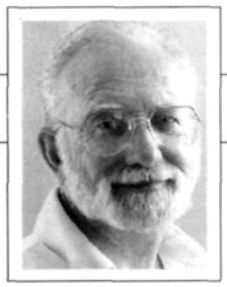
Richard Cracknell, St. Catherines, Ontario, Canada



RAZOR-SHARP TRAILING EDGES

Use a table saw to notch a length of lumber, as shown. Glue 1/64-inch-thick plywood to the bottom of the trailing-edge stock, and then set it in the notch. Sand off the excess balsa, and you'll have a really sharp trailing edge. ***Ross Frid, Cadillac, MI***

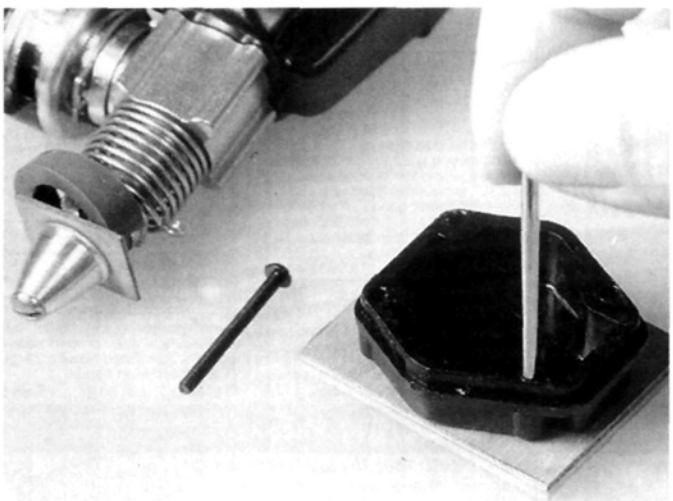
How To:



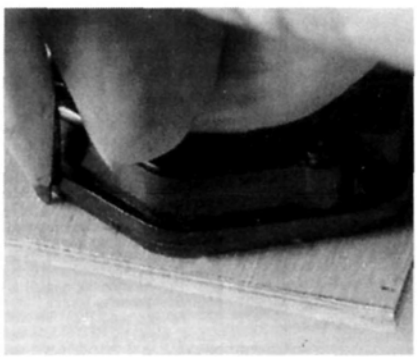
RANDY RANDOLPH

MOUNT A DRAGONFLY

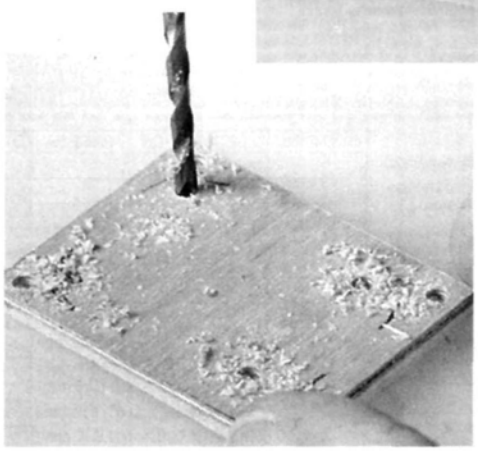
The Cox Dragonfly .049 engine comes with a working throttle, a muffler and a large tank with clunk for inverted flying—unique features for a small engine. Mounting the engine without completely disassembling the tank requires access to the back of the firewall, which is an inconvenient method. Here's how to make the mount a permanent part of the engine.



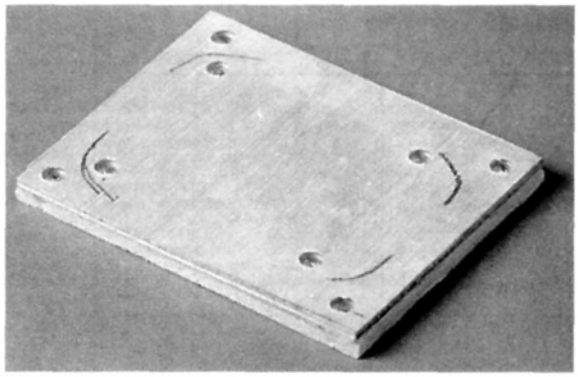
1 *To make a radial mount, cut a 1¼x1⅝-inch piece of ⅛-inch-thick plywood. Remove the four nuts from the back of the tank, and center the tank backplate on the plywood. Use a small awl (or nail) to mark the position of the four mounting holes on the plywood.*



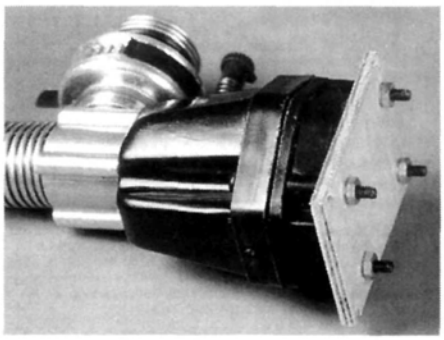
2 *With the tank backplate still in place on the mount and the mounting holes centered over their marks, use a sharp pencil or pen to mark the outside corners of the tank backplate on the mount.*



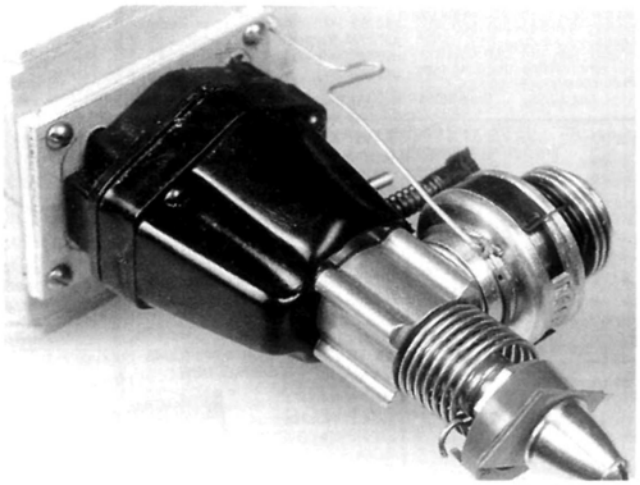
3 *In the four corners of the plywood mount, mark the positions of four more mounting holes that are ⅛ inch outside the backplate outline. Drill these holes and the four others using a 3/32-inch drill bit.*



4 *Apply several coats of butyrate dope or clear epoxy paint to the finished mount to protect it from fuel and oily exhaust residue.*



5 *Reassemble the tank backplate, and bolt the engine to the mount. Since the bolts and nuts protrude behind the mount, it is still necessary to mark and drill the firewall to receive them.*



6 *The engine can now be mounted on the firewall with wood screws. The U-shaped bend in the throttle line is for adjustment.*

AIR SCOOP

CHRIS CHIANELLI

The '93 RCHTA show held in Chicago was full of great new products and surprises. The Air Age Saturday night party—bound to become a Chicago show tradition—was again a huge success filled with fine food, bad dancing and silly behavior. I spy for those who fly!

Frank "Don Francisco" Garcher brings down the house with "Bye, Bye Blackbird."

Bruce Holocek, CEO of Hobbico (left) and Air Age group publisher Louis DeFrancesco Jr.

Thunder Tiger president Aling Lai is stricken with the giggles as I seat him on Midwest president Frank Garcher's lap.

Editor-in-chief Tom Atwood (left) and publisher Dr. Louis DeFrancesco engage in "man talk."

Louis DeFrancesco leads the charge and ad manager Sharon "Elke" Warner onto the dance floor.

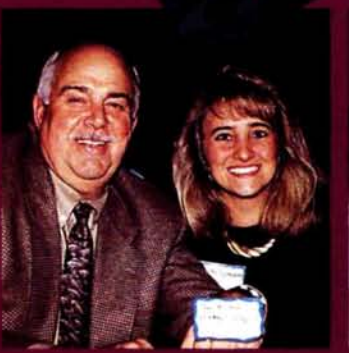
MRC's VP of Product Development Frank Ritota and purchasing manager Donald Boyce audition for "The Man With Two Heads Part II."

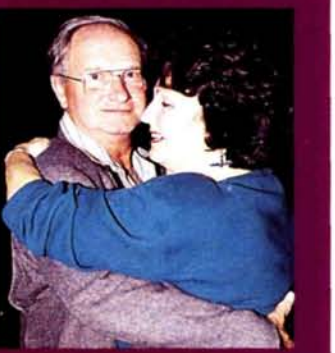
The best seat in the house, courtesy of Hans Graupner, president of Graupner Modellbau.

Horizon Hobby's marketing publicist Chris "Stan Laurel" Miksovsky turns on the charm while Air Age's dynamic ad exec Jill Sherter is busy not noticing.

Modeling mob sit-down. From left: Frank Garcher, Hans Graupner, Stefan Graupner, Jim Martin and me.

Every Air Age party is the same–the guys won't leave the girls alone! From left: Hobby Lobby president Jim "let's make a deal" Martin and Air Age's lovely ad exec Shelley Byington, yours truly and our stunning managing editor Julie Soriano and Robart owners Bob Walker and his vivacious wife Sylvia.





YS .91AC Air Chamber

Joining the ranks of the fine high-performance line of YS engines is this new 4-stroke F-91 with the reliable supercharging air chamber system that has worked out so well on their F-120AC. As with all other YS engines, the new .91 uses a pressurized fuel system for superior fuel-delivery continuity. Muffler and wrenches are included. Contact Futaba Corp. of America, 4 Studebaker, Irvine, CA 92718.

GAM-05 Cobalt

This 05 samarium cobalt is the first in a new line (035 to 40) of motors from Cermark Electronics and Model Supply. This high-performance motor incorporates compact, lightweight design with large inlets and an open endbell for better cooling and higher output. Other features include adjustable timing, a dynamically balanced armature, low-profile alloy brush holders and brush caps for easier installations and 12-piece samarium cobalt magnets. Retail price $99.95. Contact Cermark Electronics and Model Supply, 551 Mulberry Ct., Buffalo Grove, IL 60089; (708) 808-0145; fax (708) 808-0146.

NEW Perspective

While the Goldberg built-up Sukhoi is relatively new, it isn't exactly a "Scoop" item anymore. It was, however, one of the main topics of the Chicago Hobby Show. Moreover, I wanted to get a picture of pretty Carol Pesch, national sales manager for Goldberg, in my column. Here, Carol offers an interesting perspective on the plane's size by comparing her 5-foot, 6-inch height to a top view of the model. While the 6-foot-wingspan Sukhoi is big, it's not so big that you need a van to get it to the flying field. I've always felt there was a lack of interesting offerings in this size category. Companies like Goldberg, Lanier with their Lazer and Midwest with their AT-6, are beginning to answer the call. The seasoned sport flier is eagerly looking for attractive homes in which their .90s, 1.08s and 1.20s can reside. Goldberg will be hanging "sold" signs on this design for a long time to come. Thanks for the help, Carol.

Monster Musketeer

Altech Marketing unveiled this almost-ready-to-cover, all-wood (obechi-sheeted foam wing), giant-scale wingspan Beechcraft Musketeer at the Chicago show this past November. Because of the special attention that control linkages of giant-scale models require, Altech recommends the Musketeer for experienced modelers. From a safety standpoint, I agree. However, applying a 25- to 26-ounce/square foot wing loading to a .40-size sport plane is one thing, but applying those numbers to this 96-inch-wingspan, 15-pound giant is quite another. The Reynolds numbers will surely push this design firmly into the pussycat category. I wouldn't be surprised if basic training could be performed with the quick-study novice. Anyway, we'll have more info when one becomes available to us.

Joining the ranks of Hobbico's prop-driven jet series of models is this ARF version of the Patriot. This .40- to .46-size jet-style sport plane has all the same specs as the built-up Patriot, except that it's 90 percent finished! There's no building, covering or painting needed. It's truly a "buy it on Friday, fly it on Sunday"-type model. For the impetuous jet-fighter jock.

INSTANT AFTERBURNER

Glitter-Sticks

Can't find a gift for the modeler who has everything? Guidari's new Gimbal Handle Golden Series™ stick-ends could save the day. These gimbal handles come in "RC Short"—a traditional length for thumb-fliers and in "RC Long"—specially designed for radio-tray users. All handles feature: Delrin plastic handle with non-slip sandblasted finish, 24k gold-plated locknuts, CNC construction and real Czechoslovakian crystal stone. For more information, contact Guidari R/C Intl., 170 University Ave. W. Suite 12-103, Waterloo, Ontario, Canada N2L 3E9; (519) 648-3033.

GLOBAL F7U

The tailless Chance Vought Cutlass—the first production naval aircraft to achieve supersonic flight and to be catapulted from a carrier while carrying nearly 5,000 pounds of external stores—is now available in two sizes from Global Hobby Distributors. The Cutlass 45 (shown) features balsa construction and a 60-inch foam wing and calls for .40 to .50 2-stroke engines. With a tuned pipe and retracts, this thing is going to be a real speed demon. A 34-inch-span Cutlass 10 for .10- to .15-size engines is also available.

WAYNE'S Raven

Former U.S. Navy fighter pilot Wayne Handley and his Raven hold the world record for 67 inverted flat spins! I get a headache just thinking of it. Wayne probably sips tea on the way down. Anyway, under exclusive license, Global is offering an all-balsa kit of Wayne's Raven that has a 62-inch wing, 638 square inches of area and requires a .60 to .65 2-stroke engine. Global has sure come out with some nice stuff lately! The Global Raven will be available in the spring of '94.

Russian Muscle

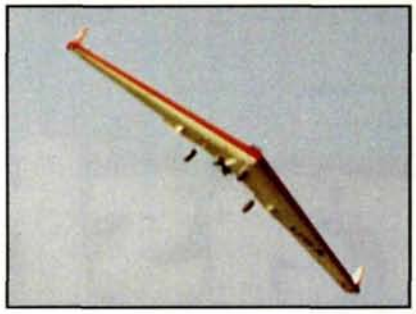
Not far from Moscow is the SAVMA mechanical engineering and motor facility that employs some 8,000 people. For years, the company has been developing their model-engine department, and now that the nation has opened its doors to the world market, it's poised for full production. Constructed in typical robust Russian tradition, the MDS line of 2-stroke glow engines features modern technology such as, Schnuerle porting, ABC piston/liners, twin ball bearings and twin-needle carburetors. But wait! The best part is the price. The side-exhaust and rear-exhaust .61s pictured here retail for $109.95 and $134.95 respectively. Apply standard discounts to those suggested list prices, and we're living in the 1970s once again! Thank you, Mother Russia! Also coming are .40, .25 and .21 front-intake/side-exhaust engines. For more information, contact Robbe Model Sport USA, Township Line Rd., Belle Mead, NJ 08502.

MODEL AIRPLANE CONSTRUCTION NEWS MAGAZINE

A Northrop-inspired sport flying wing

THE FLYING WING certainly isn't anything new, but it does have a certain mystique about it that I can relate to, having lived in a town close to Northrop Aircraft in the late '40s. The last of the pusher-prop driven wings (YB-35) had been built, and work on the jet-conversion program (YB-49) was still under way. I can still remember the government's decision to scrap the wings in 1949, but at 15 years old, I had little understanding of the politics involved.

My earliest experience with flying-wing design in the late '40s involved constructing manila paper gliders and test-flying them at the high school gymnasium. U-control was popular then, and tractor-powered, straight-slab wing designs started appearing on the scene. Radio-controlled versions of the same basic design are still popular today, although when I hear the term "flying wing," I still envision the majestic Northrop sweptback wing designs of the '40s.



The Winglet

PHOTOS BY RICHARD M. ENGEL

by
RICHARD M. ENGEL

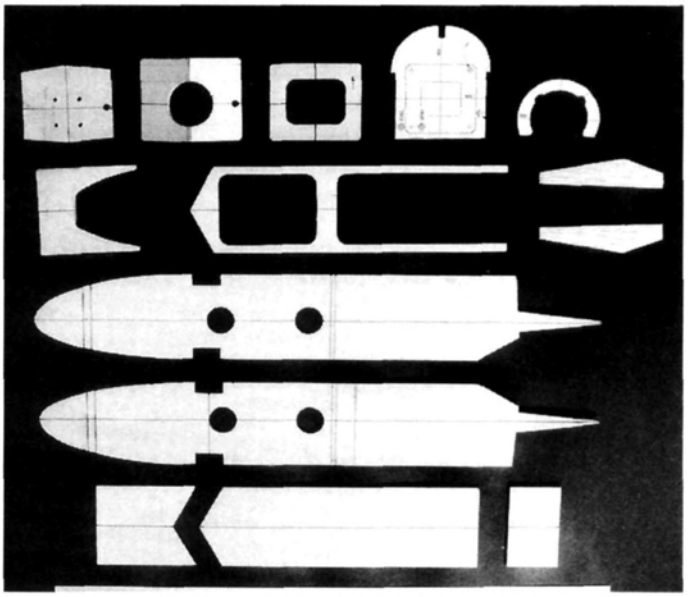
MODERN WINGS

My renewed interest in flying wings started a few years ago during the development of the Northrop B2. My flying buddy Jim Riera, a connoisseur of unusual designs, had scratch-built a constant-chord pusher-powered wing way back when, and we both had a great deal of fun flying it. We decided that two wings would look great flying together. I took off on a different route, however, and constructed a "military-look" compound tapered-wing design, pusher-powered by a .40 4-stroker. It flew well the first time and had many successful, fun flights. The "Winglet" is an improved sport version of this original design.

OVERVIEW

The Winglet is a pusher-powered flying wing with radio "mixer-type" elevon control, optional split drag-control surfaces and flight lights. The flight lights are controlled by actuation of the drag-control surfaces (low position) and are strictly a fun thing to use during your last flight at dusk. The construction is entirely built up of balsa, plywood and spruce. No so-called high-tech materials are involved—not that there couldn't be. A little old-fashioned carving is required. The nose-piece, the canopy and four cover panels are removable; this allows access to the nose gear, the nose-gear servo, the throttle servo, the left and right elevon servos, the drag-control servos and the light bays.

The receiver lies over a foam-covered fuel tank and nests within the canopy. The antenna is fed through an internal plastic conduit that runs along part of the wing length prior to exiting. A remote start plug is used to avoid the close quarters around the prop, and a switched 3V battery pack supplies power for the flight lights. It's not a beginners project, but those who decide to tackle it will find it quite rewarding.



The major components for constructing the Winglet's center section.

SPECIFICATIONS

Type: sport flying wing

Wingspan: 74.25 in.

Length: 31 in.

Height: 12.6 in.

Weight: 112 to 116 oz.

Wing area: 900 sq. in.

Wing loading:
18 to 19 oz./sq. ft.

Power req'd: K&B* .40

Prop: APC* 10x6 pusher

No. of channels req'd:
5 (1 elevator/aileron mix)

GETTING STARTED

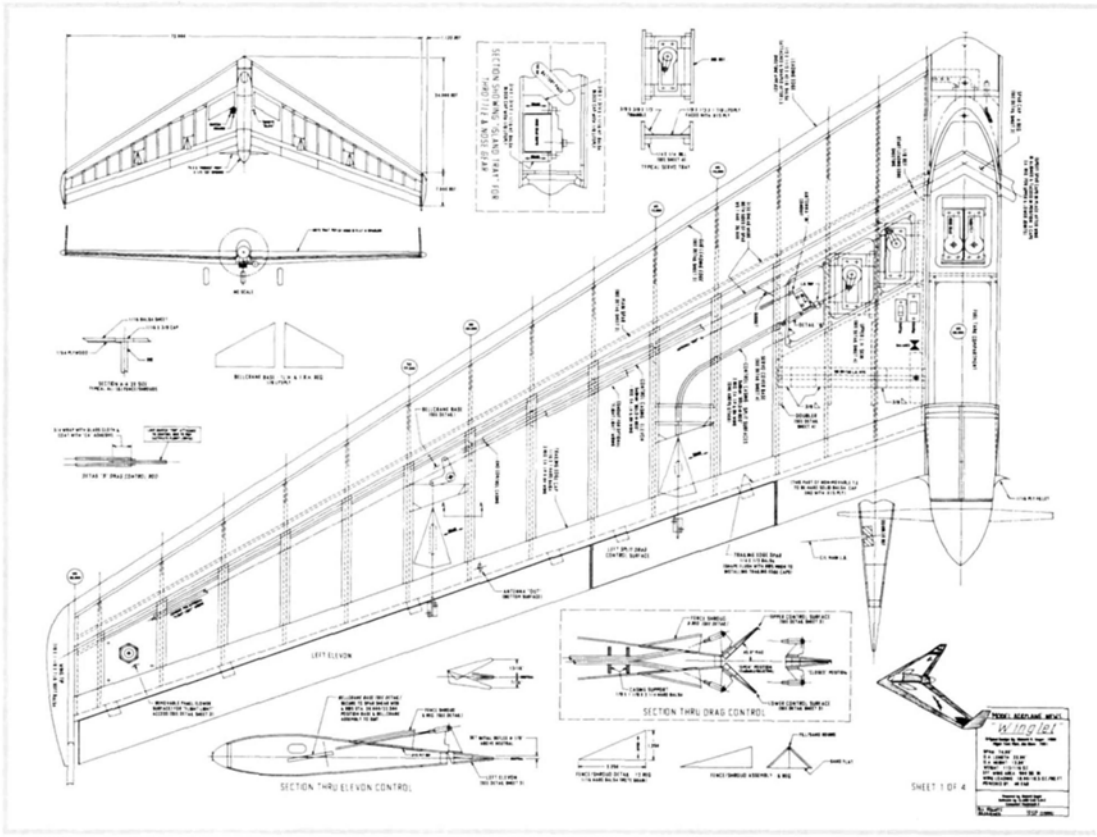
The basic construction consists of four major sub-assemblies: left wing, right wing, center section and canopy. In addition to your standard working tools, a 42- to 48-inch-long straightedge is desirable. Select the best-quality materials. Especially check materials for uniformity and straightness. After studying the plans and reading the construction information, a good way to begin this project is to start cutting out, sizing and identifying the many detailed parts required. Ensure that all your detailed parts have accurate reference lines marked on them as shown on the plans. These are required for accurate alignment during assembly. Note the grain direction on some of the parts. Carefully align and then secure the left- and right-hand wing plans to your work surface.

CENTER SECTION

It's suggested that the center section be constructed first because it will be used as an assembly jig for aligning and joining the left- and right-hand wing assemblies. It's also much easier to handle at this stage when you perform some of the detail tasks, such as planking, carving and sanding. The final width of the center section should be 3 inches. The material you use for the two side panels may not be exactly ⅛ inch thick, so you may have to make all the parts that fit between them slightly wider to achieve the 3-inch dimension. Locate the side panels, the upper base, the bottom, the bottom aft, the forward landing-gear bulkhead, the forward tank bulkhead and the engine-mount bulkhead.

Lay out the forward landing-gear bulkhead, and drill holes through it for four landing-gear bracket T-nuts and the steering control rod. Lay out the engine-mount bulkhead and drill holes through it for four T-nuts, the fuel line, the vent line and the throttle-control rod. The T-nuts will be installed later. Check the side panels, and ensure that they are exactly alike. Lay out the bulkhead locations on the inside surface of each side panel. Orient and secure one of the panels in a flat position. Glue the three bulkheads into place, and check for squareness. Note that the forward tank bulkhead is indented ⅛ inch from the lower edge and ¼ inch from the top edge of the panel. Glue the opposite panel in place. Use a square or your

The completed Winglet shows the traditional building technique. Note the use of flexible pushrods on the prototype.



best method to ensure alignment all the way around. Fit and glue the bottom, the bottom aft and the upper base into place. The top surface of the upper base should be 1/8 inch below the top edges of the side panels.

Within the fuel-tank compartment, fit and epoxy the two 3/8-inch balsa triangle corner braces into place. Fit and glue the 1/4-inch balsa triangular material in all the remaining corners of the fuel-tank compartment, as well as in all the corners of the servo compartment aft of the wing spar. Locate the bottom forward part shown on the plans (the floor of the balance weight compartment). This part is not shown as a separate detail. It will fit between the forward landing-gear bulkhead and the forward spar bulkhead. Make one out of 1/8-inch lite-ply. Fit and glue it into place 1/4 inch up from the bottom surface of the center section. Epoxy two 3/8x1 7/8-inch long balsa triangle corner braces into place. Note that one end of each rests on the floor of the balance-weight compartment.

The nose-wheel installation is typical, and a nose block is used to fill the space in the leading edge. It's best to couple the steering servo with the aileron channel.

Install the engine mount and the four T-nuts. Install a prop and spinner on your engine; accurately position the engine on the mount; mark the four hole locations; and drill through or drill and tap as required depend-ing on the mount selected. Transfer the fuel vent line position from the rear of the bulkhead to the rear of the engine mount. Remove the engine and the mount. Drill a hole through the flange of the mount to clear the fuel vent line. Put the center section aside for now.

CANOPY ASSEMBLY—1

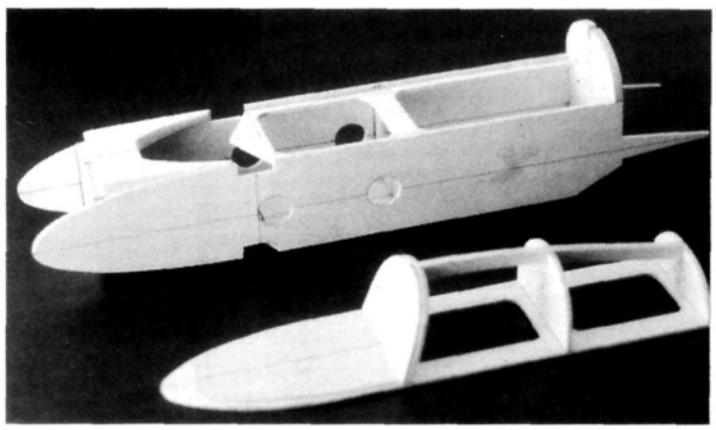
Find the canopy base, the backbone and bulkheads A, B and C. Lay out the center line and bulkhead locations on the canopy base. Glue an 1/8-inch-thick by 1/2-inch-square lite-ply doubler to bulkhead C, and drill through the joined parts for a 3/16-inch-diameter dowel as shown on the plans.

Position the canopy base on the center section and check it for fit. Bevel the end of the base to match the rear face of the engine-mount bulkhead. Tack-glue the canopy base to the top of the center section in four places. Fit and glue the three bulkheads and the backbone into place. Ensure that bulkhead C is flat against the engine-mount bulkhead.

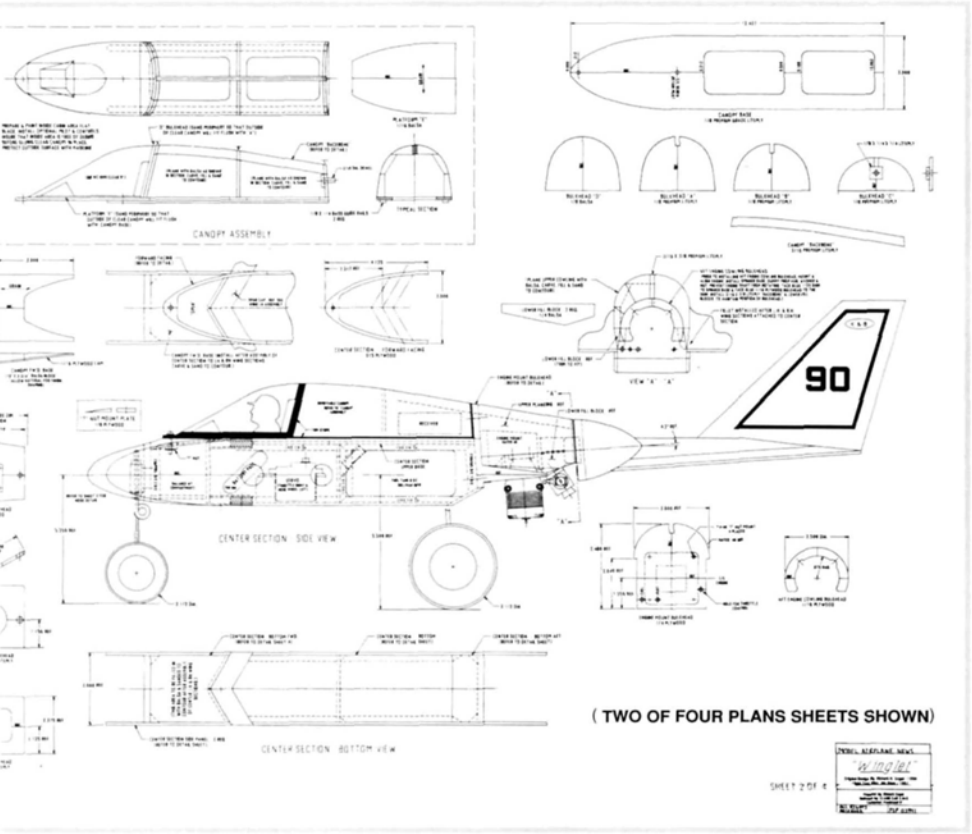
Plank the area between bulkheads A and B, and B and C with 1/4- and 3/8-inch-thick soft balsa a shown on the plans. Use aliphatic resin fo this procedure. Leave enough stock for con touring. Don't worry about perfectly fittin each piece. After rough shaping, balsa strip and filler can be used to fill in the voids Rough-shape the planked surfaces.

CENTER-SECTION ENGINE COWL

Locate the aft engine-cowl bulkhead. Tack glue three 1/32-thick by 1/4-inch-square ply wood shims to the rear of the bulkhead— one in the center and the other two 10 degrees both sides of center close to the out side diameter. Align and tack-glue the rea of the spinner base to the shims. Install th spinner base/bulkhead assembly and dummy prop hub, washer and nut on th engine shaft. Mount and align the engin

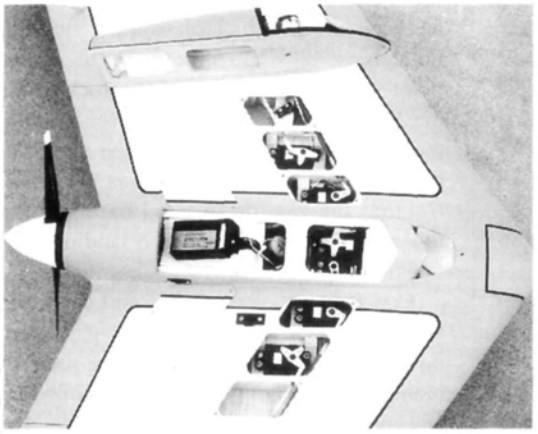


The completed center and canopy framing sections.



(TWO OF FOUR PLANS SHEETS SHOWN)

FSP03941–PRICE $20–ORDER FULL SIZE PLANS ON PAGE 107



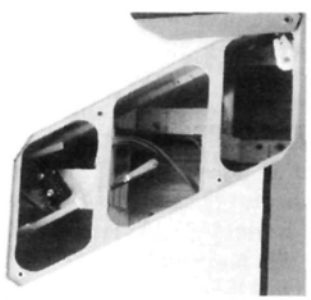
The easy access to the inside of the Winglet adds to the enjoyment of operating the model. A remote glow-plug wire makes the engine easy to start.

again. Align the spinner base/bulkhead, and prevent the engine shaft from rotating. Fit and glue a straight length of 3/16x3/8-inch lite-ply from the top slot of the engine-mount bulkhead to the rear face of the cowl bulkhead. The top of this part should form a straight line from the cowl bulkhead to bulkhead B of the canopy.

Fit and glue the two lower filler blocks into place to maintain the position of the bulkhead. Plank the area between the bulkheads. After the glue has thoroughly dried, cut through and remove the shims with a razor blade to free the spinner base; remove the engine. Rough-shape the planking and aft edges of the engine-mount bulkhead. Use a sanding block to finish-shape and blend in the contours of the engine cowl with the compound contours of the canopy.

CANOPY ASSEMBLY—2

After finish-shaping and sanding operations, remove the canopy from the center section. Locate the plastic canopy, bulkhead D, platform E and two 1/8x3/16 basswood rails. Trim the peripheries of the bulkhead and the platform to allow the plastic canopy to fit flush with the mold line of the canopy assembly. Glue the platform and the bulkhead into place. Protect the surfaces of the plastic canopy with masking tape, and trim it to fit. Prior to gluing the plastic canopy into place, prepare and paint the cockpit area flat black; install your favorite pilot and controls.



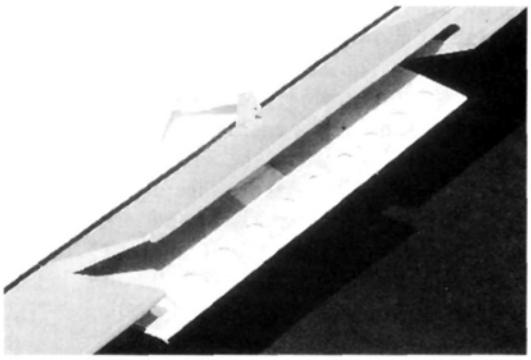
With the left-hand servo compartment panel removed, you can see the pushrod and optional lighting system microswitches. The panel is held in place with four screws.

Mark the location of the guide rails on the bottom of the canopy assembly; tack-glue them into place. Position the canopy assembly on top of the center section, and check it for a flush fit. Glue the rails permanently. Install the 3/16-inch-diameter dowel in place as shown on the plans. Mark and drill a hole in the aft engine-cowl bulkhead to match it. Drill the hole a little low so that you can work it in and obtain a tight canopy assembly fit. Construct the throttle and nose-gear servo mounts. Align and epoxy them to the floor of the center section.

LEFT/RIGHT WING ASSEMBLY

Locate the stepped spar material (1/4x1/4- and 1/4x1/2-inch spruce), and prepare four spar assemblies as shown on the plans. Prepare the two 3/16-inch-thick balsa trailing-edge support tools and secure them to the work surface. Position them so that the end of each rib is flush with the aft surface of the tool. Trim the inboard angular end of each left- and right-hand lower spar for a good fit. Align and secure the spars in place. Additional trimming will be required when you fit the wing assemblies to the center section.

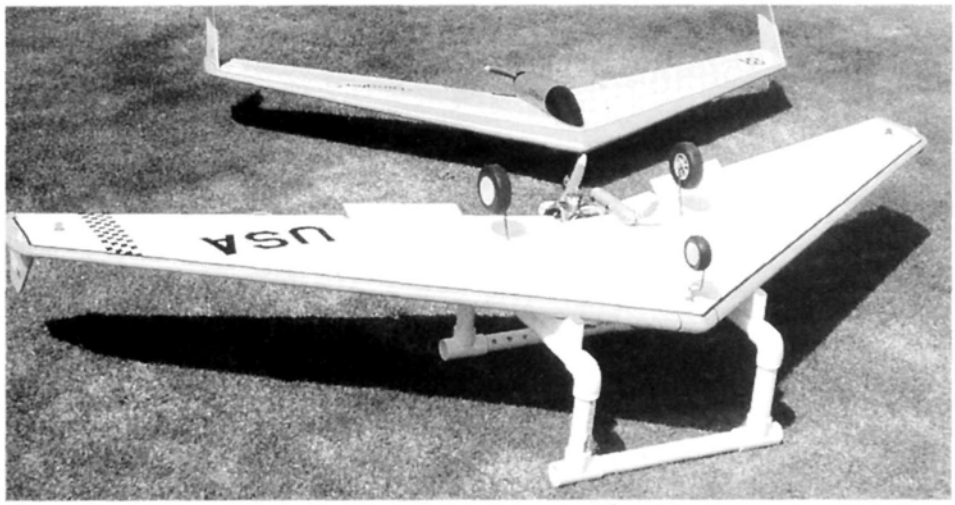
Trim every rib spar slot to fit, and ensure that every rib lines up properly on the plan. With the exception of the left- and right-hand root ribs, glue everything into place. Ensure that the end of every rib rests on the trailing-edge support tool. Check the ribs for squareness. Lay a straightedge across the tops of the ribs to ensure alignment.



The completed and deployed drag-control surfaces on the right wing. The plans show the construction in detail.

Taper the upper and lower edges of the 1/4x1/2-inch balsa trailing-edge spars for a flush fit with the ribs. Carefully tack-glue the spars into place. Avoid gluing the spars to the trailing-edge support tools. Glue the 1/16x1-inch upper trailing edges into place. Use weights to secure the ribs and the trailing edges.

Glue the sub-leading edges into place. Some trimming of the forward ends of the



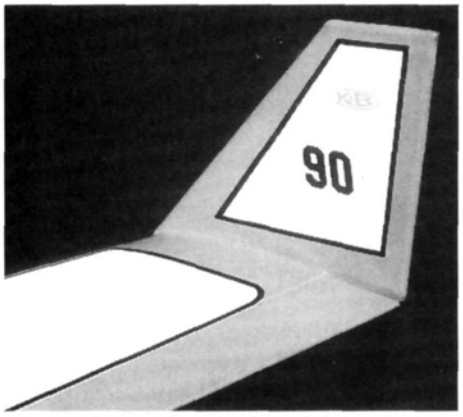
The engine starting position for the Winglet is inverted on its PVC cradle. The second prototype is in the background.

ribs may be required to ensure straightness. Fit and glue the upper stepped spars into place. Weight the wing assemblies down, and let the glue dry thoroughly. Remove each wing assembly from the work surface. Turn each assembly over. Align and secure the right-hand wing on the left-hand plan; align/secure the left-hand wing on the right-hand plan. Glue the 1/16x1-inch lower trailing edges into place. Use weights to secure the ribs and the trailing edges.

Remove the wing assemblies; flip them over and place them in their proper positions on the plan. Place a 2-inch-thick shim block under each wingtip; align/secure each wing section; square the loose root ribs (shown on the plans as W.S. 1.560) and glue them into place. Fit and glue the 3/32-inch vertical-grain shear webs into place on both sides of the main spars. Sand the shear webs and sub-leading edges to match the rib contour. Note where the leading-edge sheeting starts. Prepare the sheeting and glue one edge to the spar. Use several strips of masking tape (3/4-inch tape on 1-inch centers) to secure the sheeting to the ribs and sub-leading edge; and glue the sheeting from the inside. After drying, remove the tape and excess glue.

Sheet the lower leading edge in the same way, but apply the glue to the ribs prior to taping. It's a good idea to have the strips of tape already attached to the sheeting. After drying, trim and sand as required. The leading edges will be attached after assembly with the center section. Trim both wing sections; sand the face of each wingtip flat. Fit and epoxy the landing-gear blocks, the doublers, the 3/8-inch triangle braces, the servo trays and each 1/16-inch plywood servo-cover base into place.

Carefully fit and glue (aliphatic resin) the upper and lower right- and left-hand



The finished vertical fin of the right-hand wingtip.

inboard wing skins into place. Cap the remaining ribs with 1/16x3/8-inch balsa. Sheet the upper and lower wingtips as shown on the plans. Construct two fence shrouds, and put them aside until the controls are installed (four shrouds are required if the optional split drag-control surfaces are used). Sheet the areas where the control rods exit the wing; note that 1/64-inch plywood is laminated to the 1/16-inch balsa sheeting. Glue all the gussets into place. Prepare the "non-movable" inboard trailing-edge sections as shown on the plan. Align them with the flat areas of the sheeted wing; glue them into place; fill in as required; and sand them flush.

WING JOINING TO CENTER SECTION

Ensure that the inboard face of the inboard rib and trailing edge (with the exception of the protruding spruce spars) is trimmed and sanded flat. Trim the upper and lower spar slots of the center section so that each wing section will slide into place. This will take several trim-and-fit operations. When you're satisfied, align and secure (weights are good here) the center section (minus canopy) on the plan. Slide the wing sections into place; position the 2-inch-thick shim blocks under the wingtips; and check the overall alignment. Trimming of each upper inboard end of the spars will be required; shimming of the center section may be required. When you're satisfied, coat each wing section end face with 30-minute epoxy. Again, slide the wing sections into place; position the 2-inch-thick shim blocks under the wingtips; align the trailing edges; check the overall alignment; secure the assembly; and let the glue dry thoroughly. Fit and epoxy the forward spar bulkhead and the four spar caps into place.

FINAL CONSTRUCTION

Position the left- and right-hand leading edges. Trim the inboard ends to fit against the center section; glue the leading edges into place, and mark a leading-edge reference line on the full length of each wing section. Glue the canopy forward base into place, and fill in the lower area aft of the forward landing-gear bulkhead with balsa. Rough-shape the nosepiece, and finish the sides, leaving excess material so that the contour can be finished when the nosepiece has been tacked into place. Contour the leading edges; tack-glue the nosepiece into place, and use a long sanding block that's masked at one end (to avoid over-sanding the leading edges) to finish-shape the nosepiece (use the leading edge as a guide). Contour the canopy forward base and the lower area aft of the forward landing-gear bulkhead.

Construct the vertical fins and carve the wingtip blocks. Temporarily tack-glue them into place to finish-sand and shape them to blend with the wingtip contour. Construct and install the elevons, the servo trays, the bellcrank bases, the access covers, the split drag-control surfaces (optional), and the flight lights (optional) as shown on the plans. Fill in and finish-sand the completed framework, and install the control system. Apply your favorite covering, paint and/or trim to the sub-assemblies.

Align and then glue the vertical fins and the fence shrouds into place. Install the main landing gear, the nose gear, the engine (ensure muffler clearance), the remote glow-plug receptacle and the fuel tank. Finish assembly, and install the balancing weight in the nose section as indicated on the plans. Ensure that the balance point is as indicated or preferably 1/4 to 3/8 inch forward of that point, for your test flight. Also, if necessary, check and correct the balance along the Y-axis.

(Continued on page 34)

Tom Kenny built this ¼-scale 1929 Curtis Falcon from Effinger plans. It's flown here by Dick Booth.

Keith Coover lands his ⅕-scale Stuka after a successful dive-bombing mission.

Lee Moore's 13-year-old, ¼-scale PT19 has logged more than 400 flights on its original 2.4cid engine.

Bomber Field BIG BIR

• PHOTOS AND STOR

B.B. WEBER from Houston, TX, loves scale R/C models, especially B-17s. He's so wrapped up in R/C that several years ago, he bought 50 acres way out in the country (about 35 miles northwest of Houston) and built a magnificent R/C model field. Naturally, he named it "Bomber Field." With a 600x50-foot paved runway, a 800x75-foot grass runway paralleling the paved runway and a 150x50-foot ramada with a covered observation deck on top, this R/C field ranks with the best in the country.

As you can imagine, this fine facility is put to good [illegible] year around with day-to-day flying plus several large meets scheduled during the year, including a fan-jet fly-in.

But the big one is the annual Big Bird Fly-In held in [illegible] September to October time frame. This year was [illegible] and it was held on September 17, 18 and 19. I have attended all but one, and they have progressed from great to greater. And I'm not talking about just numbers of pilots or planes (approximately 140 pilots this year). I'm talking primarily about the variety and quality of the planes, the unusual number of top-notch pilots, the uniqueness of 10 or 12 big bombers that fly, and finally, the friendly Texas hospitality that stresses and practices, "Let's have [illegible]." And [illegible] Street

[illegible]-scale Sukhoi has an [illegible] 26x18 prop, 185-inch [illegible] 44 pounds. See story [illegible].

An 1/8-scale, 13-foot Avro Lancaster on final. (Designed, built and flown by Wayne Bransfield.)

Background shot: three B-17s and a Lancaster fly in open formation.

The best big-bird fly-in in the country.

Tom Street built this D-18 from Ziroli plans.

FLY-IN

BY DAN PARSONS •

Everyone's favorite biplane—the Beech Staggerwing.

Eight B-17s on the runway at Bomber Field.

Jody Pasztor's Nosen P-51.

Rick Michelena's 110-inch, scratch-built C-130.

Now, let's get on to the pilots, planes and, best of all, the flying.

As I climbed out of my car on Friday morning after arriving at the field, I had a sense of déjà vu. Why? Because the first plane I heard and saw flying was none other than Stinger Wallace's big P-51 thundering down out of a dive for a low pass, its Husqvarna 6.0cid engine bellowing. This scene had greeted me at the huge Joe Nall Memorial Fly-In held at Hartness Field, Greenville, SC, in May. (My story on this outstanding meet is in the November '93 *Model Airplane News* issue.)

This was certainly a fine start for the Bomber Field Big Bird Fly-In.

TAKE TO THE SKY

With five lines and many pilots already in the pits ready to go, the flying quickly got down to serious fun.

Not to be outdone by Stinger, that intrepid team of Joe Pasztor and his son, Jody, blasted off together with their Nosen P-51s, which are amply powered by Husqvarna 6.0cid engines. Boy, what a show they put on! They do fine formation flying, but their real forte is realistic dog fighting. With no holds barred, they chased each other all over the sky from on the deck right on up to at least 1,000 feet.

With fine piloting combined with great vertical performance and speed (provided by those big Husqvarnas), they were able to get on each other's tail many times for a good "shot" in any flight attitude. To quote the great WW II German fighter ace, Hans-Joachim Marselle, "A fighter pilot should be able to aim his guns from any flight attitude: in a turn, in a climb, in a dive, or even while rolling." The Pasztors put several excellent flights together during the three days, clearly demonstrating this principle.

Nine B-17s and two Avro Lancasters provided many bomber flights, the best being when at least once a day, four or five would fly together in "loose" formation. (It is extremely difficult to fly even three planes in anything resembling "close" formation, much less four planes.)

Though there was a preponderance of warbirds at this meet, there were also civilian types. Certainly, one that caught my eye and camera was a 1/5-scale Waco bipe well-flown by 11-year-old Nick Setar from San Antonio. It was built from the Pica kit, and Nick has been flying it for two years with many flights in his log book. His dad taught him to fly when he was eight, using a Falcon 56. Most young kids take to R/C like ducks to water—too bad we don't see more out there flying. How about it, dads? (I watched Chip Hyde wring out an Ugly Stik at the '77 Nats when he was four years old; the transmitter seemed half as big as Chip.)

The full-scale B-17 Thunderbird on final for a flyby over eight B-17s parked on the runway. Note the radar gun aimed at the the Thunderbird.

Another civilian type that caught everyone's eye was George Snider's 1/3-scale Sukhoi. With a wingspan of 103 inches, this is a big plane. It was built from plans, had a balsa fuselage and a foam-core balsa-sheeted wing and is absolutely gorgeous. Its 44 pounds are hauled through the sky with authority by an opposed twin-cylinder 8.4cid engine. With smoke generators on each cylinder's exhaust, the smoke output is the best I've ever seen—spectacular against a clear, blue sky.

Tom Street flying B.B.'s Lancaster while B.B. (behind Tom in the white cap) operates a separate transmitter that actuates the bomb-bay doors and the flaps and releases the bombs.

On Saturday and Sunday, time was set aside for not only the flight of four or five bombers but, better yet (to me anyway), also three separate flights of five WW II fighters mixing it up all over the sky. As soon as one flight would land, the next one would roar off—and I do mean roar! Course, each flight would always end up in a low-pass contest with lots of enthusiastic support and urging from the large crowd of spectators.

Besides the 11 four-engine bombers and a 110-inch C-130, there were several twin-engine planes: a Ziroli B-25, a D-18 Twin Beech and a DC-3, a Hensvhell 129B, a deHavilland Mosquito and the "daughter" of Mosquito, my deHavilland Hornet. This total of 18 multi-engine planes at one meet is, by far, the most I've ever seen and is certainly a record. And they all flew, most of them several times—another record. Even at large meets with 200 to 300 pilots, there are usually only two or three multis. So, what have you wrought here, B.B.?!

Rick Michelena from McAllen, TX, put on quite a show with both his 110-inch C-130 and 88-inch P-47; especially so with his scratch-designed C-130. Besides flying it four or five times each day, he shot many touch-and-go's on each flight. You seldom see fliers making Ts and Gs with a multi-engine scale model.

When I asked Rick how he got the frequency pin so many times each day, he just grinned and said, "I've made arrangements." He also told me he had five other giant-scale planes at home and flies them all. Oh, I almost forgot, his beautiful C-130 won Best of Show. Now there's an active, all-out scale R/C'er. In his "spare" time, he flies 737s for America West Airlines.

Another 737 pilot (for Southwest Airlines), Tom Street, was in his normal role of flying many other modelers' planes as per their owners' request. He also, as usual, was flying his own multi-engine plane—a beautiful rendition of a D-18 Twin Beech from Ziroli plans. Tom has been flying R/C since he was seven and is one of the top R/C fliers in the country. Sadly, on the third flight during this meet, his D-18 became uncontrollable and was destroyed. Aileron flutter is suspected, but not confirmed. I'll have more to say about flutter later.

Not only was Joe Pasztor putting exciting flights on his seven-year-old Nosen P-51, but in between, he also relaxed by flying his relatively new 97-inch deHavilland Mosquito he built from a British kit. Weighing 32 pounds, powered by G-23s swinging three-blade 15x8 props,

B.B. Weber is about to grease his 10-foot B-17 onto his own runway at Bomber Field.

As a grand finale to the fly-in, B.B. had arranged, as he had with all previous events, for several flybys on Sunday of the full-scale B-17 Thunderbird.

his "Mossie," though not as spirited as his P-51, flew very well. I was especially interested because, as I mentioned earlier, I've always considered my deHavilland Hornet twin-engine fighter as the daughter of Mosquito. Joe and I wanted to get our deHavillands up together, but we never did.

However, I did some "formation" flying with Jerry Miller's Ziroli B-25. Exactly as per scale, I had to throttle way back to keep from over-running Jerry's G-23-powered B-25. We made a couple of pretty flybys together, and then I gave Jerry a high-speed top-cover pass immediately after he touched down on the runway. Fun!

A great warbird that is seldom seen at any meets is the Ju 87 Stuka dive bomber. Well, Keith Coover is helping to change that situation; he has two 1/5-scale Stukas he built from the Ziroli plans. He built number one as sort of a prototype or test bed to see how it would fly. And yet it is finished and detailed well enough to be very competitive in many scale contests.

So you can imagine what a beautiful plane his number-two Stuka turned out to be when he built it for his "finished" version. Both are powered by 4.2cid engines he bought from Ralph Cunningham of R/C Ignition in Phoenix. Several months ago, during a phone conversation I had with Keith, he told me that his first Stuka was "a fantastic flier." After seeing him put both of his Stukas through their paces, I understand his enthusiasm. During his dive-bombing routine, he switches on a siren aboard, and one is tempted to take cover!

B.B. Weber not only loves B-17s, but now he also loves a 126-inch four-engine Avro Lancaster bomber he had Frank Johnson build for him. (Frank now owns Westcraft, well-known for their 10-foot B-17 kit.) On Saturday, B.B. made a perfect bomb run with his Lanc and laid a string of 30 bombs right on the target, which was the far edge of the paved runway. Flour in each bomb added realism.

Then, on Sunday, with Tom Street flying B.B.'s Lanc and B.B. handling the separate transmitter for the bomb-bay doors, bomb drop and flaps, they went on a bombing mission with another Lanc—an 1/8-scale 13-footer built and flown by Wayne Bransfield. Tom and Wayne did some pretty darn good formation flying. Wayne comes all the way down from Burlington, Ontario, Canada, and this was his third trip to Bomber Field with his Lanc. All foam, it weighs only 38 pounds and uses four 70 Surpass 4-strokers. On Saturday, Wayne unintentionally overshot the runway and made a go-around on only the two outboard engines. To say the least, it was nip and tuck all the way around, but he made it.

Bomber Field and the pits. Note the control tower and the second-story observation deck in the background.

As a grand finale to the fly-in, B.B. had arranged, as he had with all previous events, for several flybys on Sunday of the full-scale B-17 Thunderbird. Flying from its base at Houston's Lone Star Museum, it arrived over Bomber Field at 1:30, right on schedule, and made several flybys, both parallel to and perpendicular with the runway. It was an inspiring sight and a field day for all video and camera bugs present.

There are many more pilots, their planes and their flying that I very much would like to write about, but Major Tom tells me I now have to sit down and be quiet.

However, before I do that, remember earlier I mentioned that horrible word "flutter"? Two gorgeous planes, Tom Street's D-18 and Scott Broughton's Yellow Spitfire were probably victims of flutter. Also, at the recent Madera, CA, R/C Unlimited and T-6 races, there were three and possibly more planes lost because of flutter. Although this problem has been with us since the early days of R/C (I had an attack in 1961—plane survived), it apparently is a growing problem. Makes sense because of bigger engines, more efficient props and cleaner planes, which lead to higher speeds.

What to do about it? First, if you don't have copies of the March and April 1993 issues of *Model Airplane News*, buy, beg, borrow, or steal them, and read the two-part series, "Flutter—Causes and Cures" by Carl Risteen. These are excellent articles, well-written and full of useful info that may save your next plane, especially if it is a scale model. Second, always consider the possibility of flutter, learn all you can about it, and experiment with solutions. Someone suggested we should be talking to people in the Experimental Aircraft Association about how they deal with flutter.

I know that everyone who attended this fly-in, both spectators and pilots, and especially the pilots, join me in thanking and congratulating B.B. Weber and all the members of the Bomber Field Club who worked long and hard putting on this truly outstanding meet. In my opinion, it is now the best big-bird fly-in the country. ■

WINGLET

(Continued from page 26)

FLIGHT PERFORMANCE

Adjust the elevon control as shown on the plans. If the split drag-control surfaces are used, set them initially for a maximum opening of 60 degrees included angle (30-degree top and 30-degree bottom travel). A variable or two-position (high-low) channel should be used for this function. If your control allows, couple the nose gear and aileron channels. Ensure that everything functions properly. I use a PVC pipe rack to support the wing upside-down so that the engine is more accessible and easier to start.

Adjust your idle for a slow taxi speed. Taxi around a bit for "feel," and check your nose-gear movement. You'll probably find that not much control is required. Make all the necessary adjustments, and line 'er up on the runway. Start off slowly to ensure direction, and increase to full throttle. Stay down on the runway until maximum speed is reached before slowly feeding in "up." After gaining altitude, avoid any quick control movements; idle back a bit and adjust your trim. After getting some "stick time" in, try some aerobatics. Instability is usually caused by over-control and/or the need for more nose weight.

If you use the split drag-control surfaces, make sure that you have enough "up" control to handle the nose drop that will occur. For the first landing, minimize the use of the drag-control surfaces. To reduce speed, feed in a little repetitive "up" when making your final approach, but avoid making large control movements just prior to touchdown. Also, be aware of the "ground effect" when landing. Good morning and happy flying!

**Here are the addresses of the companies mentioned in this article:*
***K&B Mfg. Inc.,** 2100 College Dr., Lake Havasu City, AZ 86403.*
***APC Props/Landing Products,** P.O. Box 938, Knights Landing, CA 95645.* ■

AIRWAVES

(Continued from page 9)

Other vital areas skipped over by the reviewer include information on essential topics such as our perspective of an airplane in flight; how to trim for a hands-off; wings-level glide flight; establishing fixed landmarks for use when navigating one's plane to a desired destination; and the field checklist provided in tape five: "Getting Airborne," just to name a few.

To say this material is irrelevant does injustice to every beginner and many seasoned pilots. My novice students have no problem assimilating the new concepts that I have introduced in this tape set. I am surprised that the reviewer would miss the most innovative new concept in R/C flight instruction since the buddy box. I never expected to undertake such a ambitious project without making some mistakes. The reviewer made some legitimate observations regarding the material in these tapes; however, a majority of what Mr. Raskin has to say misrepresents the material presented, and leads me to believe he did not take the time to understand it. Even experts can derive benefit from the direction-of-travel rules, if they approach the concept with an open mind. Vol. 1.2 will contain corrections of any legitimate mistakes that I am specifically made aware of. When they become available, the producer will provide Vol. 1.2 upgrades, at a very nominal cost to those who have purchased Vol. 1.1.

WALTER BERGGREN
Author of R/C Flight Instruction Videotape Series Vol. 1.1

Walter, it's our policy to offer a rebuttal opportunity when a product is criticized in Model Airplane News. Jef Raskin's review of the tapes was so negative that we took the unusual step of having him send a few of them back to us prior to publication for our own review. Jef

(Continued on page 129)

PILOT PROJECTS

A LOOK AT WHAT OUR READERS ARE DOING

SEND IN YOUR SNAPSHOTS

Model Airplane News is your magazine and, as always, we encourage reader participation. In "Pilot Projects," we feature pictures from you—our readers. Both color slides and color prints are acceptable.

All photos used in this section will be eligible for a grand prize of $500, to be awarded at the end of 1994. The winner will be chosen from all entries published, so get a photo or two, plus a brief description, and send them in!

Send those pictures to: Pilot Projects, Model Airplane News, 251 Danbury Rd., Wilton, CT 06897.

NORSE "SQUINT SCALE" P-40

Tore Hansen of Norway built this pretty O.S. 70 Surpass-powered Curtiss P-40 from a Tim Farrell design published in *Model Airplane News* (FSP12891). The 62-inch-span design, which Tore has flown successfully for more than a year, is as easy to fly as it was to build. For added realism, Tore used Robart scale struts on the landing gear and scale ailerons and flaps on the wings. All markings were hand-painted. Good job, Tore!

SWEDISH CARAVELLE

Jens Tornblad is serious when he goes to the slopes. His latest project—an SA Caravelle III—is his own scratch-built design. A wingspan of 82 inches helps keep this 5½-pound model in the air. Except for the balsa tail, the plane is made entirely of brown paper and foam. The Caravelle is dressed in Royal Swedish Air Force livery (used for intelligence gathering over the Baltic Sea). Jens says his plane has a "nasty habit of tip-stalling when the speed gets too slow." The photos were taken in the Norwegian Alps.

BRITISH DUCK

Arthur Fox of Nottingham, England, built this Peter Bowers design—the "Duck"—from a plan published in "Flying Aces," August 1939. Its 50-inch wingspan is twice that of the original, because, as far as Arthur is concerned, "the bigger, the better!" Powered by a Saito 120 4-stroke and steered by a 3-channel JR radio, the plane weighs 18 pounds. It won the trophy at the '92 Argus Specialist Publications/Vintage Models Rally. We are not surprised!

DUTCH DUCTED FAN

Hans van Dongen sent us these pictures from Holland of his Rafale ducted-fan kit (we're guessing a Philip Avond scale jet) that's powered by a Rossi .90 ducted-fan engine turning a Ramtec fan unit. Hans made the scale cockpit detail and the pneumatic wheel doors. At 12 pounds, the plane flies very well.

PILOT PROJECTS

ISRAELI SE5a

Israel Shaked built this stand-off-scale version of the SE5a from Rich Uravitch plans (FSP03852). The balsa-and-ply plane has a 50-inch wingspan, and it's powered by an O.S. .61 4-stroke. Israel says the plane looks great, and he's pleased with its performance.

ITALIAN AKROSTAR

Rotesi Roberto of Italy sent us this beautiful picture of his precision-scale version of the Wagner-Hizt Akrostar—"a fantastic airplane built in Switzerland about 25 years ago." A SuperTigre S .90 turning a 14x6 Zinger wooden prop propels this aerobat. The plane has a fiberglass fuselage and foam wings covered with obechi and light fiberglass cloth. The wingspan is 70 inches, and the plane weighs about 11 pounds. A Futaba FF7 radio controls the five onboard servos. Rotesi says that the plane is a great flier and that during slow aerobatics, it looks like the real thing.

SPANISH 1/5-SCALE BURGESS-DUNNE

José Pico Goicoechea of Asturias, Spain, scratch-built this beautiful, museum-scale masterpiece from the original plans. The scale model has a 110-inch wingspan; it weighs 13 pounds; and it's powered by a 1.20 4-stroke engine mounted in a pusher configuration. It flies like a dream, but it takes about an hour to mount all the flying wires and turnbuckles. (They're arranged just like the original.) The model has more than 100 turnbuckles and 75 feet of wire—all of which are operative!

CAP 21 DOWN UNDER

David Edmunds of the Geelong Miniature Aircraft Association, Victoria, Australia, sent us this photo of his Funkey 1/4-scale Cap 21. He uses a Futaba FF7 radio to fly the 16 1/2-pound, Quadra-4.2-powered aerobat. The plane has an 84-inch span, a glass fuselage, foam-core wings, and it's painted with acrylic auto paint. The Geelong Flying Club (about 130 strong) has a field about 80 miles from Melbourne. Tell us, David, is it true that your caller has to make sure the field is clear of kangaroos before you turn onto final?

JAPANESE DELTA LADY

Nobuyuki Masuda scratch-built this 3-channel glider from a Mike Trew design published in the February '79 issue of *Model Airplane News* (FSP02792). The plane has a 56-inch wingspan, and it's 37 inches long.

Masuda-san comments: "I always take a photo before I crash it."(We are in total agreement with this philosophy!) Here, the plane, which Nobuyuki describes as a graceful flier, is shown in great shape after two hours of flight. To all of our friends in the Pacific Rim: send us more material for "Pilot Projects"!

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1989 Rhinebeck WW I Jamboree; Southwest Fan Fly; Arizona Fan Fly; New England Ducted-Fan Fly; Engine Review: Fitzpatrick 61; Mid-west Hots II; Jimmy Doolittle, Mike Johnson & the Gee Bee R1 Racer.

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F&B: Hobby Lobby Sinus, Sig 4 Star 40; The Making of "Always"; Radio Review: Airtronics Spectra PCM7H; Construction: Bucker Jungmeister; How to: Muffler Pressure for the .049.

❒ **JUNE '90**
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❒ **JULY '90**
Jo Kotula—Model Airplane News' King of the Covers; Engine Review: Enya .80 XF; F&B: Carl Goldberg Models Freedom 20; Great Planes Model Mfg. Ultra Sport; Bob Parkinson Models Regal Eagle; Radio Review: Futaba FP-5UAF; Heli Review: Hirobo MH-10/BK-117; Construction: Fat Cat.

❒ **AUGUST '90**
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❒ **SEPTEMBER '90**
The Formula 1 Midgets, Mini Reno Warbird Racing, F&B: Sports Aviation EZ Dago Red, United Model Distributors Electric Tsunami; P&B: Robbe Schluter Bell 222UT; Mini Construction: Rogallo Wing.

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Floatplane Special: Fiberglassing Foam Floats; Beauty & the Beast; Scale Float Documentation; Clearlake '90; F&B: Falcon 880; deLackner Heli Vector; Construction: Bellanca P-200-A.

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Kit-Bashing Special: From Aero-Star to Terror Trainer; The Optimized Electric, Part I; "Always" Super Catalina; Quantum's Nickel-Hydrogen Batteries; F&B: Graupner Race Rat, Futaba Professor 40; Engine Review: Rossi .61; Construction: Ultra Hots.

❒ **DECEMBER '90**
Introduction to Scratch-Building, Part I; Bryon Aviation Expo '90; Sheeting Foam-Core Wing Panels; the Kalt Whisper; the Ultimate Bipe; FREE MODEL AIRPLANE NEWS PLANS DIRECTORY.

❒ **JANUARY '91**
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❒ **FEBRUARY '91**
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❒ **MARCH '91**
Optimized Electric, Part II; 1990 Tournament of Champions; Pilot Projects 1990 Winner; QSAA Rally 1990; Hot Wings; Hobby Shack EZ Calm 25; Engine Review: Super Tigre G .34; Construction: Y'Not.

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❒ **OCTOBER '91**
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❒ **NOVEMBER '91**
8-Page Pull-Out: Carburetor Basics; AstroFlight Zero-Loss Connectors; 1991 Mid-Columbia Slope Race; Design for Flaps, Part Two; 1991 IMAA Rally of Giants; Setting Up Your Model With the Ace Micropro 8000; Great Planes P-51D Mustang; Model/Tronics Psycho Max; 10 Steps to a Fiberglass Cowl; SR External Battery Pack; Construction: Fred's Special.

❒ **DECEMBER '91**
Airplane Factory Kombat 40; Byron Aviation Expo '91; EZ Christen Eagle 40; Engine Evaluation: Webra Speed .61F ABC; '91 Nats; Keith Shaw on Electric Twins; Construction: 1/4-Scale Minimax; Heli Section: 2nd Annual Kyosho Helicopter Challenge. FREE MODEL AIRPLANE NEWS PLANS DIRECTORY.

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❒ **MARCH '92**
Features: Hobbico P-40 Warhawk; Improve Performance by Reducing Drag—Part 3; Air Flair Lectric Schtick Twin; 1991 Greater Southwest Fan Fly; Richard L. Branstner; Using Lower-Nitro Fuels; Altech Super Stearman; Sporty Scale Special Feature—Authentic Aluminum; Helicopter Section: Schluter Cup 1991; Basic Helicopter Aerodynamics; Construction: Cad-Cat; Columns: Engines Aloft; Aerobatics Made Easy.

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Features: A Successful Flight Training Program; Carl Goldberg Models Extra 300; Robbe Pitts S1; Engine Review—ASP 108 ABC Sports; How to Compute the Mean Aerodynamic Chord; The Gilbert Approach to Landing; Construction: Build In-line Fuselage Retracts; Columns: Aerobatics Made Easy, etc.

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❒ **NOVEMBER '93**
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❒ **DECEMBER '93**
Features: Kitty Hawk Revisited; Holiday Wish List; Cermark ARF Sukhoi .60; Make Easy Elliptical Foam Wingtips; Byron Sukhoi SU-26M & Webra 4.4; R/C Launcher & Pit Crew; Bob Violett Models Maverick; O.S. Max .61 RX-H; 6th Annual Giant Warbird Festival; Horizontal Tail Design, Part 2; How To Make a Model Shipping Container; Real Performance Measurement: In-Flight Testing; Construction: F4D-1 Skyray.

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Features: Building with Laminated Balsa; Florio Flyer Coal Hauler; Sig Samurai; 1992 Scale Masters; CG Location; Basic Soldering Techniques; Flutter: Causes & Cures—Part 2; Helicopter Section: Engine Review: Rossi R60 Heli; Construction: Douglas F4D-1 Skyray.

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Features: The Balancing Act; Midwest's Mighty Mustang; Pull-Pull Systems for Larger Models; Rhinebeck Airdrome 26th Jamboree; RPM In-Flight Testing: Enya .60XF-4 G8 Ring; Features: Brown Baggers Don't Only Do Lunch; Kalt GS Alpha Helicopter; Construction: Notforsale—Sport Fun-fly Winner.

❒ **JUNE '93**
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HOW TO

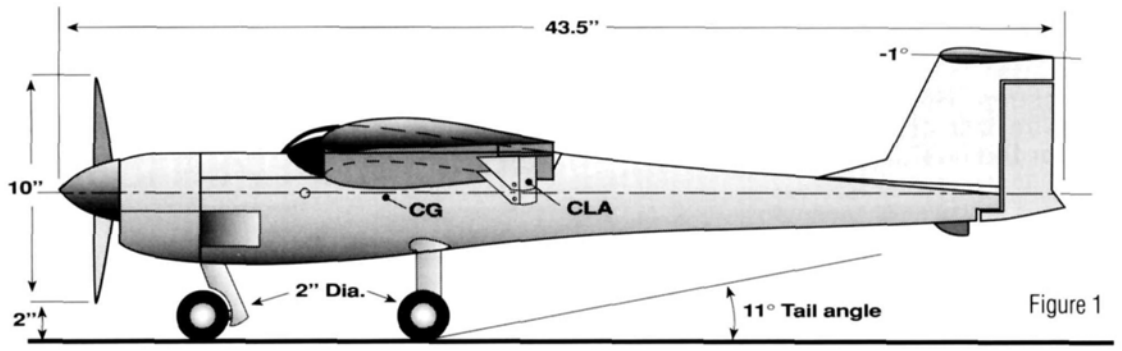


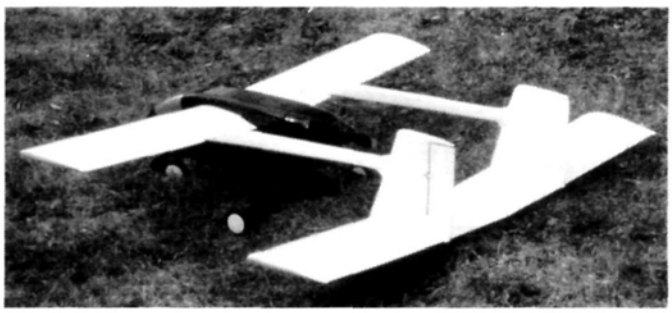
Figure 1

Landing-Gear Design Part 1

Determining the tail angle

by ANDY LENNON

THE LANDING GEAR of a propeller-driven aircraft has two major functions. The first is to provide adequate clearance between prop tips and the ground. The second, and no less important, is to permit the plane to rotate on both takeoff and landing so that the wing's angle of attack comes close to the stalling angle of its airfoil. At that angle of attack, the wing is near the airfoil's maximum lift coefficient (CL max.). This permits the lowest landing and takeoff speeds of which the model is capable.


1. The Wasp Tandem wing. The prop's position, just behind the main landing gear, has no clearance problem.

However, on the ground, it should not be possible to rotate to or beyond the wing's stalling angle. Such a stall on takeoff or landing could be damaging, both to the model and to its designer's ego!

For windy-day flying, good judgment dictates flaps-up landings, and at a lower angle of attack for good control. The wind's speed reduces the model's ground speed accordingly.

This first of a two-part series deals with the landing-gear function. Intelligent determination of the angle of attack for landing and takeoff requires consideration of the following:

- The airfoil's characteristics and the Reynolds number (Rn) at landing and takeoff speeds.
- Adjustment of "section values" to those for your wing's aspect ratio and planform.
- The effect on the stalling angle of flaps when extended.
- The impact of ground effect.
- The wing's angle of attack in level flight. If that angle is 3° and the landing/takeoff angle is 12°, then the plane has to rotate through only 9° to reach the 12° angle.
- Wings incorporating the NASA "droop" will have an increase in landing/takeoff angles.

LANDING GEAR

For conventional models, the wing characteristics control the landing/takeoff angle of attack.

For canard (photo 3) or tandem-wing models (photo 1), lift is generated by both wings. Well-behaved canards or tandem wings have front wings that must stall first, so that for landing-gear design, only the fore-plane's characteristics are to be considered, not the aft wings.

Figure 2

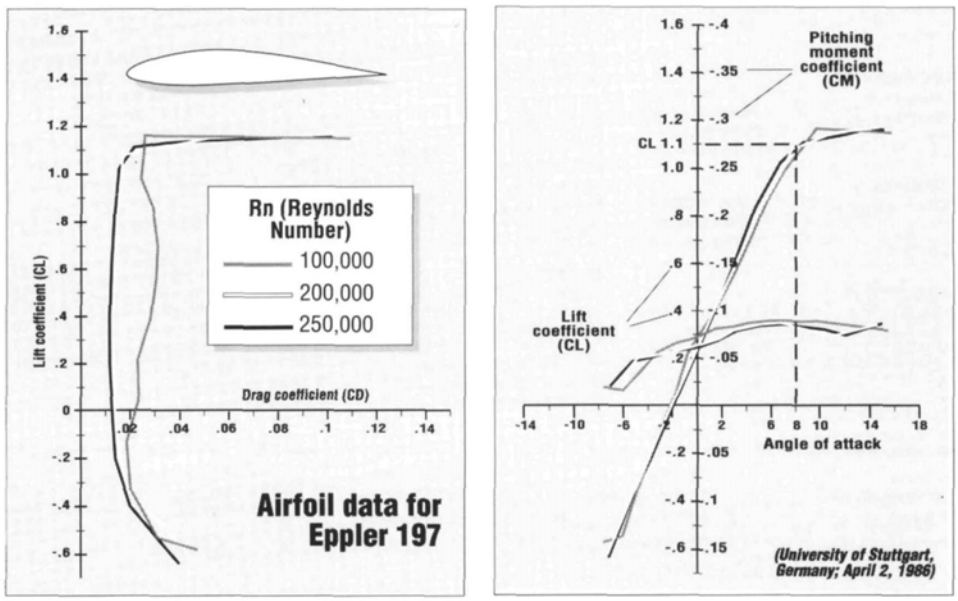
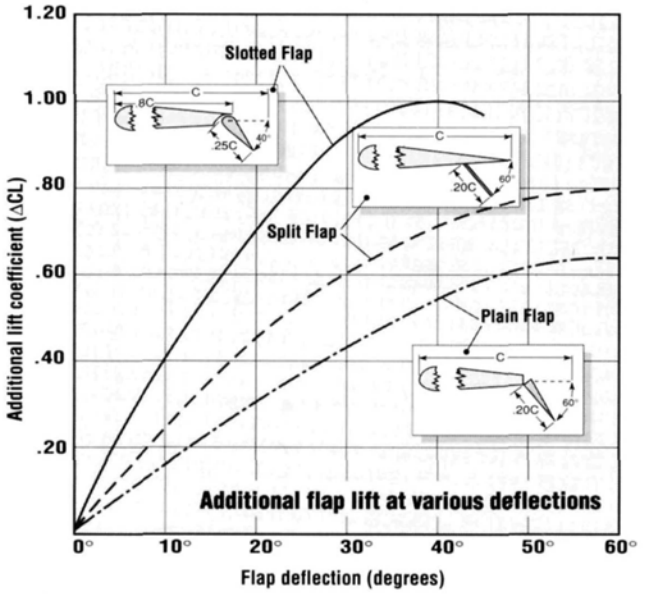
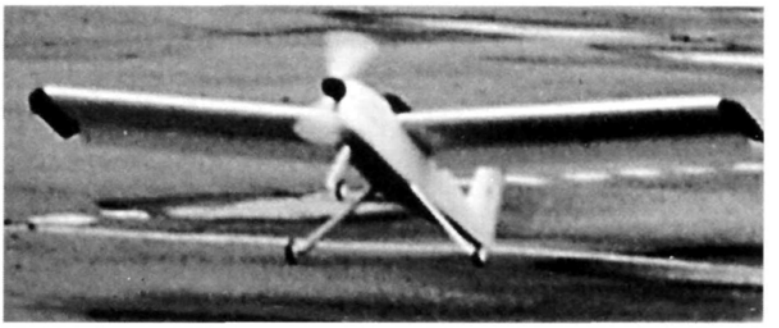


Figure 3





2. The Crane II in its very high angle of attack landing posture.

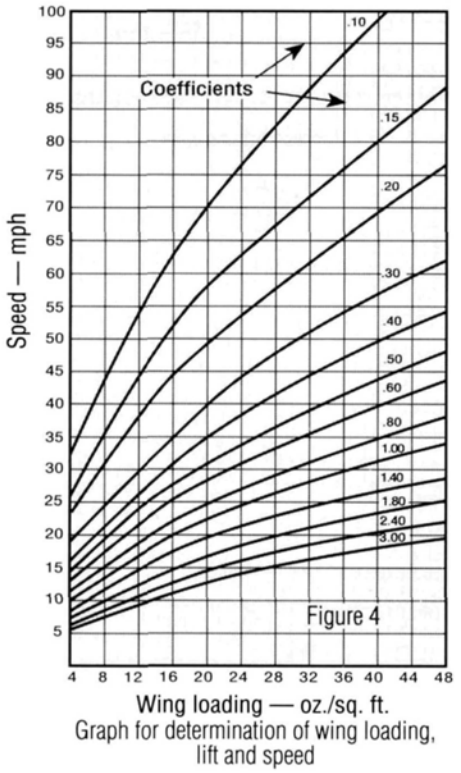


Figure 4
Graph for determination of wing loading, lift and speed

Now, about those six factors:

Figure 2 provides the lift, drag and pitching-moment characteristics of the Eppler 197. On the left, CL1.1 has been selected as the takeoff/landing lift coefficient at an 8° angle of attack. This is well below this section's stalling angle of 16°, and the stall is gentle with no hysteresis. Figure 3 gives the additional lift coefficient that slotted flaps develop. (See "Design for Flaps," *Model Airplane News*, Parts 1 and 2, October and November 1991.)

If you know (or can reasonably estimate) your model's wing loading in ounces per square foot, and if you calculate your wing's "close" to CL max., as above, with slotted flaps deployed 20° for takeoff and 40° for landing, Figure 4 will provide the means to estimate both landing and takeoff speeds in mph. The Rn is easily calculated. It is, at sea level:

Rn = chord in inches x speed in mph x 780.

With the Rn under your belt, select the appropriate Rn curves of your airfoil. Note that Figure 2 offers different curves for different Rn numbers. For E197, lift is little affected, but profile drag increases at low Rn.

SECTION VALUE ADJUSTMENTS

The values in Figure 2 are called "section values" and are for "infinite aspect ratio (AR)." A model's wing has a "finite" AR and wingtips. In addition, the wing's planform (straight or tapered) has an impact. There is a simple formula that adjusts the wing's angle of attack to provide the lift coefficient selected and compensates for both AR and planform. The formula is:

$$\alpha = \alpha_o + \frac{(18.24 \times CL)}{AR} \times (1 \times \tau)$$

Where α = total angle of attack;
α_o = section angle of attack (the total number of degrees for which you obtain a positive coefficient of lift);
CL = lift coefficient required;
AR = aspect ratio;
τ (tau) = planform adjustment factor; (Figures 5 and 6).

Using the data in Figure 2, and noting that the E197 airfoil starts to lift at minus 2° and achieves CL 1.1 at plus 8°, α_o would be 10°. An AR of 6 is used here (this depends on your design, of course).

$$\alpha = 10° + \frac{(18.24 \times 1.1)}{6} \times (1+0.17)$$

$$= 10° + 3.91° = 13.91°$$

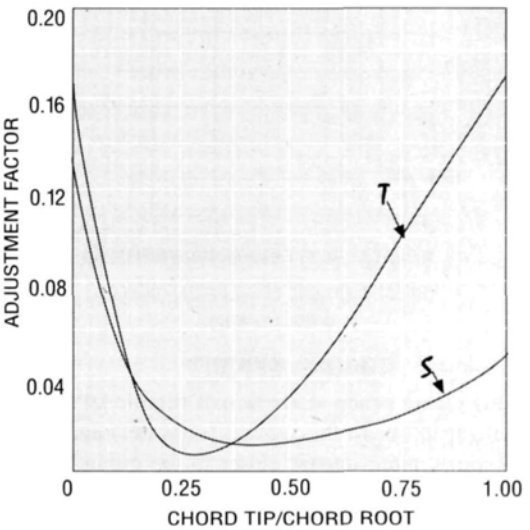
Let's say 14°—less the minus 2° (since it starts lifting at minus 2°), or 12° from the horizontal.

Summarizing: our AR6 straight-wing with airfoil E197 would require a 12° angle of attack to achieve CL 1.1.

HIGH-LIFT DEVICES

Slotted flaps reduce takeoff and landing angles of attack as shown in Figure 10. A 20° flap deflection causes a reduction of 1°, but for the full 40° deflection, it is 4°. Since landings are more critical than takeoffs, use 4°. As one former jet fighter pilot puts it, "Takeoffs are optional; landings are unavoidable."

Figure 5



Tapered-wing correction factor for non-elliptic lift distribution

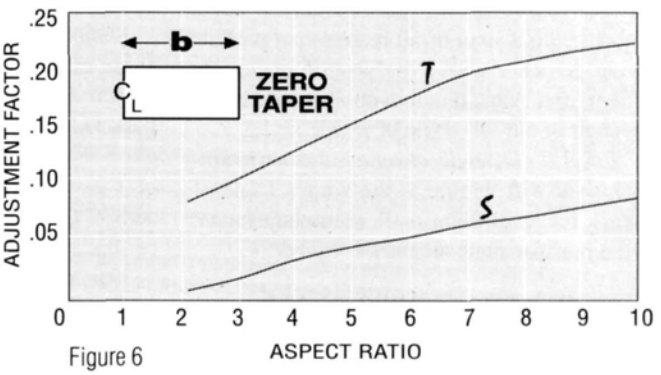
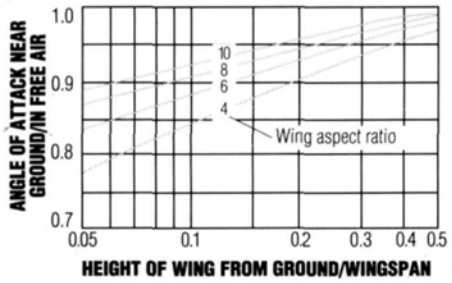


Figure 6
Straight-wing correction factor for non-elliptic lift distribution.

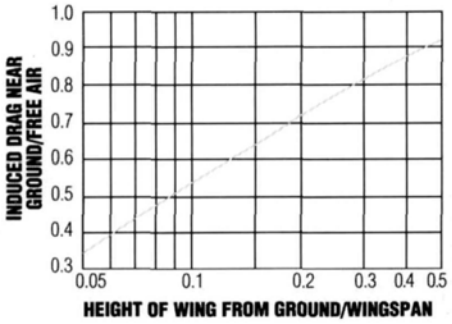
3. The Canada Goose Canard's tricycle landing gear. Propeller clearance on takeoffs and landings is critical for rear-engine canards.

Figure 7



Impact of ground effect on angle of attack.

Figure 8



Impact of ground effect on the induced drag of a wing.

GROUND EFFECT

This phenomenon starts at half the model's wingspan above the ground (or water) and becomes more intense closer to the ground. Both landings and takeoffs, hence, are made in "ground effect." It acts like a substantial increase in aspect ratio. A reduction in the stall angle of attack and in induced drag results as shown in Figures 7 and 8. For a model with a span of 60 inches, *and* with its wing 8 inches above the ground on touchdown, *and* AR6, this reduction would be 10 percent of our 12° angle of attack, or 1.2°.

Level flight angle of attack. In our example, the Swift, Figure 1, the wing's angle of attack for level flight is 0°, so no adjustment for a positive angle of attack is called for.

NASA SAFE-WING DROOP

This is recommended for sport models (Figure 9 and *Model Airplane News*—June 1990, "The NASA Safe Wing"). It delays tip-stalling and provides effective aileron control in the stall. Since the droop occupies 38 percent of the semi-span, it is estimated that it provides a full 4° more in the takeoff/landing angle of attack.

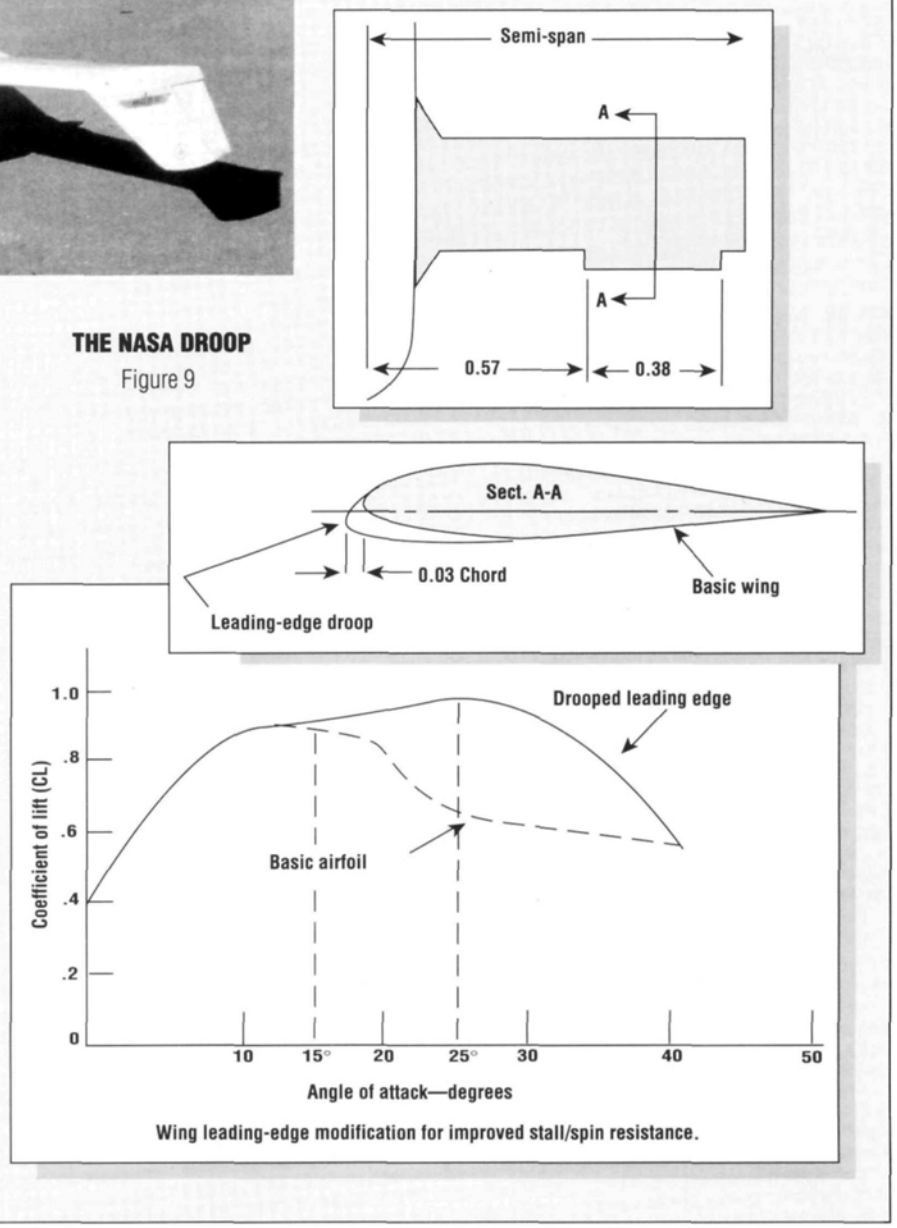
Summarizing: the adjusted angle of attack for CL 1.1 of airfoil E197 is 12°; slotted flaps reduce this by 4°; ground effect makes a further reduction of 1.2°; and the NASA droop adds 4° for a net angle of attack of 10.8°.

For the Swift, this tail angle was increased slightly to 11° to provide a 2-inch prop-tip ground clearance with a 10-inch-diameter prop.

(Continued on page 45)

THE NASA DROOP

Figure 9



Wing leading-edge modification for improved stall/spin resistance.

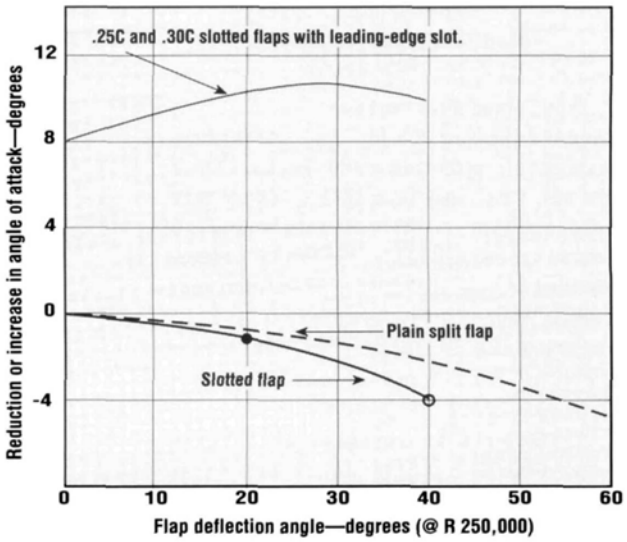


Figure 10

The effect of flaps and leading-edge slots on the angle of maximum lift.

LANDING GEAR

(Continued from page 42)

Figure 1 illustrates the benefit of a high thrust line provided by an inverted engine. If the engine was upright and still fully cowled, the thrust line would be lowered by roughly 2 inches. A landing gear 2 inches longer, to preserve the 2-inch ground clearance, would be necessary. This could entail a substantial increase in the "tail angle," bringing the wing's angle of attack to above the stall for takeoffs/landings.

The remedy would be to lower the aft fuselage to reduce the tail angle so as to avoid the stall. This would affect spiral stability as discussed in "Vertical Tail Design," January '94. The longer gear would increase both weight and drag.

THE "CRANE" II

Photo 2 shows the Crane II, a STOL model in its very nose-high landing posture. It had an 11-inch-diameter variable-pitch prop; full-span leading-edge slots and slotted flaps. Spoilers on the wing's upper surface provided roll control. The horizontal tail had an inverted and leading-edge-slotted lifting airfoil to provide the high tail download that is need to achieve the very high angle of attack (20°) provided by the wing's slots and flaps.

The Crane II had a fueled weight of 101.5 ounces and a wing loading of 22.75 ounces/square foot; power was an O.S. Max .45 FSR engine; power loading was 225 ounces per cubic inch or engine displacement (cid). (A construction article was published in the April '83 issue of *Model Airplane News*; plan no. FSP04831 is available.)

POWER LOADING

Power loading in ounces per cubic inch of engine displacement is a useful "rule of thumb" for evaluating the weight-to-power relationships of 2-stroke or 4-stroke models, but not 2-stroke versus 4-stroke.

The formula is simple:

$$\frac{1}{\text{engine cid} \times \text{gross weight}} = \text{power loading}$$

A trainer weighing 80 ounces and powered by a .40cid 2-stroke engine would have a power loading of 1/.40x80 = 200 ounces/cid. The Crane's power loading of 225 ounces/cid with a 2-stroke engine shows that it has greater weight for its power than the trainer.

Part 2 will deal with the detailed landing-gear design. ■

MODEL AIRPLANE NEWS MAGAZINE
FIELD & BENCH REVIEW

Agile foam fighter

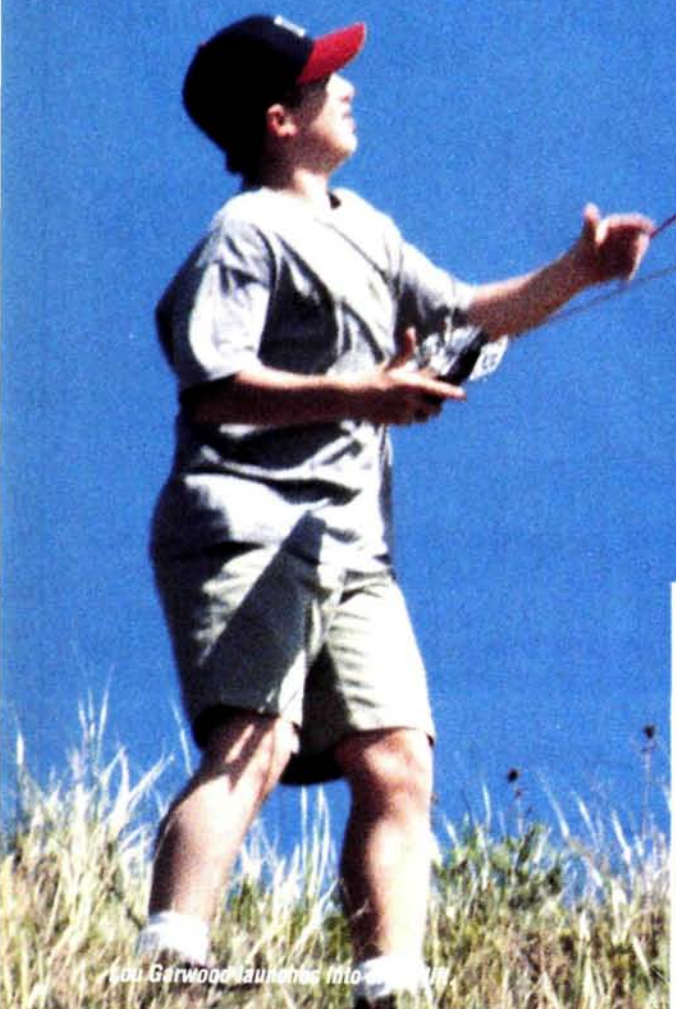
ANABATIC PRODUCTS

Anabat Combat Sailplane

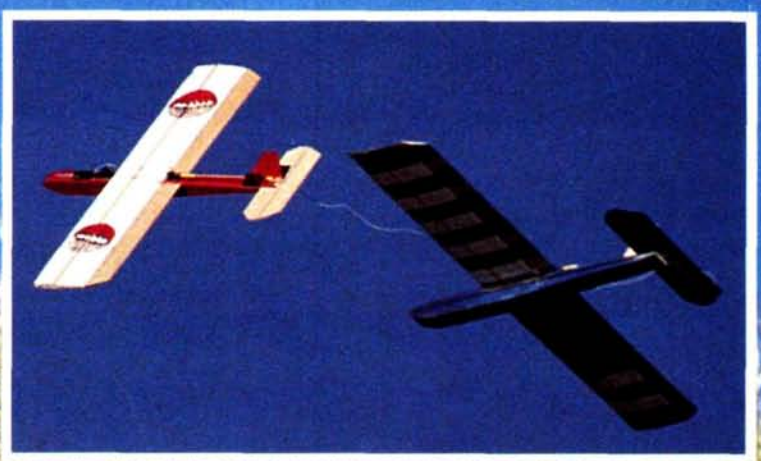
by DAVE GARWOOD

THE ANABAT COMBAT is one of a series of quick-to-build, highly maneuverable slope-soaring aircraft designed by Jef Raskin, a successful slope-aerobatics competitor.

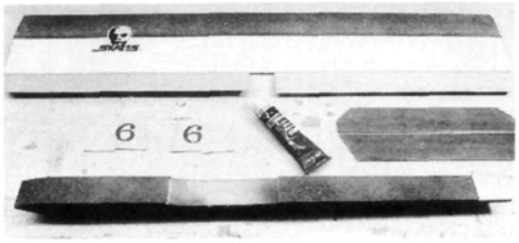
Anabatic Products* produces an aerobatic trainer and a precision aerobatics competition ship, but the Anabat Combat is designed specifically for rough-and-tumble slope combat action. The design features that contribute to this goal are high maneuverability in flight, control surfaces angled to prevent midair entanglement and toughness to resist crash-landing damage—all provided in a low-cost kit.



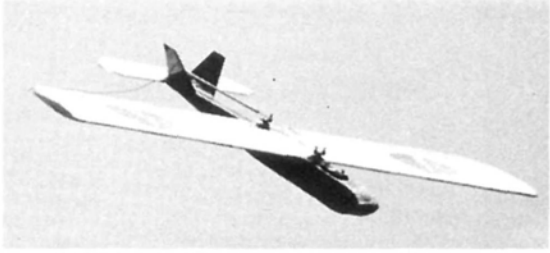
Dave Garwood launches into



PHOTOS BY DAVE GARWOOD



Airframe components include the foam wing and fuselage; the ailerons (cut out of aileron stock); and the horizontal stabilizer, elevator and fins (cut out of balsa sheet). All surfaces are covered with clear specialty tape, and the elevator and ailerons are hinged with the same tape. The wing and fins are mounted with RTV silicone glue.



An Anabat Combat enters a shallow dive before performing a loop.

KIT CONTENTS

Enough parts and materials are provided to build and cover two complete models. They include a pair of white foam wing blanks and a pair of white foam fuselages. The wood provided includes 1/16x1/4-inch spruce, 2-inch aileron stock and 1/16-inch balsa stock for the horizontal stabilizer, elevator and fins.

It's unusual for a model airplane kit to include covering material, and this kit provides a roll of clear specialty tape to cover, strengthen and protect all external surfaces of the model—both foam and wood. The tape also serves as control-surface hinging material.

The modeler must supply dowels, wire and heat-shrink tubing. The modeler also supplies three specific adhesives: foam-friendly CA glue for attaching the spars and longerons, RTV silicone glue for mounting the wing and stab and Wilhold RC-56 for toughening the servo mounts.

The 14-page instruction manual contains one photograph, 35 diagrams, a control-surface deflection gauge and meticulously detailed text describing the preparation, construction, balancing and setup of the Combat. Flying instructions are brief, cautioning that, "This kit is for experienced slope fliers," and "You should not be piloting this airplane unless you are already accustomed to flying with ailerons on the slope." Procedures are given in the manual for both two-person "full contact" combat, and several-person "rules and scoring" combat.

All materials provided in the kit are high quality: the wood is from Sig Mfg., the tape from 3M, and the foam cutting is done smoothly and accurately. A longer box for shipping the kit would have better protected the contents. Mine arrived with foam crush damage on both ends of the wing.

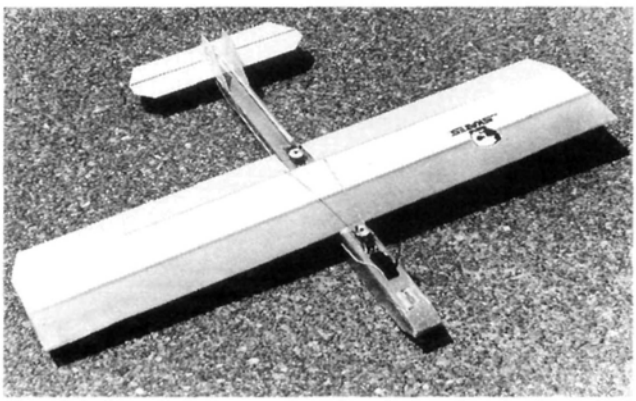
CONSTRUCTION

Anabat Combat construction goes quick and easy. My son Lou and I each built one, spending six hours over four evenings to complete them. From our construction log:

First night. Assemble the wing and the fuselage. Both have slots precut for the spars and longerons to be glued into place with CA glue. Shape the front of the fuselage with a sanding block. Paint the wing and fuselage, if desired, and let them dry overnight.

Markings on Lou's Combat were applied with felt-tip pens. Mine was decorated with a combination of spray paint for the large areas of color, felt-tip marker for the tail number and a sticker for the wing insignia. Use a light touch with the spray can, as both lacquer and enamel paint will dissolve the foam if applied heavily.

Second night. Cut ailerons out of balsa stock and sand lightly. Cover the wing and fuselage with the clear packing tape provided. The process detailed clearly in the instruction manual goes smoothly and works well. The tape covering also makes excellent gapless hinges.



Completed Combat shows external control-system hardware and external antenna mount. The designer says this has little or no effect on flight characteristics. In our models, correct balance was easily achieved with the elevator servo located behind the wing. No nose weight was required in either model with this equipment layout.

Third night. Cut, sand and cover the fins, stab and elevator. Like the ailerons, hinges are made of the clear tape. Glue the wing and stab to the fuselage with RTV silicone glue and let dry overnight.

Note: talking with other Anabatic Aircraft builders, I've learned that some common adhesives make poor substitutes for the RTV silicone, which provides a strong and resilient bond and does not attack foam. Spend three bucks and get the good stuff.

Fourth night. Radio installation in the completed airframe. Radios having a total weight of 7 ounces or less are called for by the designer. Start laying out the components while the model is balanced at the CG. Attention to detail at this stage will preclude the need to add nose or tail weight to balance the model. The

FLIGHT PERFORMANCE

• Launch and landing

Launching is easy because the high wing mounting gives room for a good grip on the fuselage. Give it a gentle toss out into light or moderate slope lift, and the model is immediately airborne. The first thing you notice after launch is how sensitive the roll control is. Once you get used to that, the model settles down and flies smoothly.

Landing is easy, using traditional sailplane maneuvers and techniques. The Combat is difficult to damage when landing because it's so light. In-tree landings result in little or no harm, and cartwheel landings generate no more damage than a bit of crushed foam. Often, no repair is needed because the covering tape holds the broken foam intact.

• High-speed performance

None. With its light weight and low wing loading, this sailplane doesn't fly fast.

• Low-speed performance

The Combat slows down well. The forward stall is uneventful, and tip-stalls were not observed. The large ailerons and elevator give positive control even at slow flying speeds.

• Aerobatics

If survivability is its mother, then aerobatics is its father. This model rolls quickly and axially from level flight, without the preparatory shallow dive generally required for maneuvers by most sailplanes. Because the airplane is so light, loops require a preparatory dive to gather speed and must be flown carefully to avoid a stall. The very best part is inverted flight. The Combat's inverted handling is so close to upright handling that the model could be re-trimmed slightly and flown inverted throughout the flight. That, plus its outstanding crash resistance, make it an excellent trainer for inverted flight.

SPECIFICATIONS

Type: Slope-combat sailplane
Wingspan: 36 in.
Wing area: 216 sq. in.
Weight: 13 oz.
Wing loading: 8.7 oz./sq. ft.
Power req'd: None
Airfoil: WE3008 (fully symmetrical)
No. channels req'd: 2 (aileron and elevator)
List price: $59.95 (for two)

Comments: a quick-to-build, highly maneuverable design that's optimized for slope combat. Rules and scoring procedures are suggested for a combat event that includes multiple pilots.

Hits
- Quick to build; inexpensive.
- Good light-lift performance.
- Highly maneuverable.
- Resists crash damage.

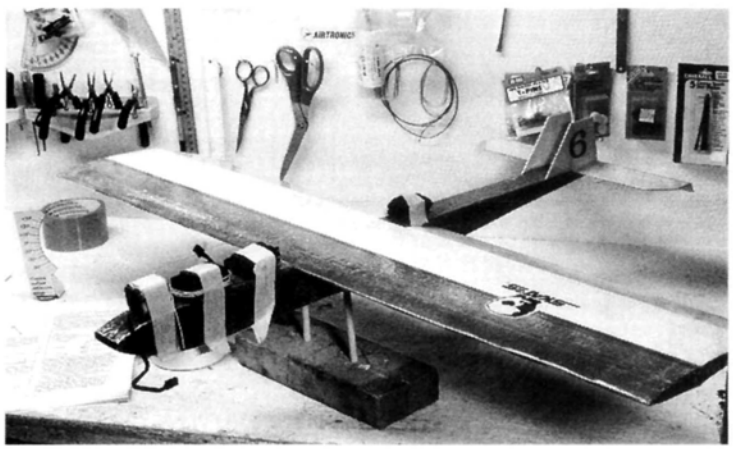
Misses
- Limited life (estimated 30 or more crash landings) if flown as intended.

instructions mention that one servo may have to be mounted in the wing, but our Combats balanced with the elevator servo behind the wing. When you have decided on their respective mounting positions, install the servos, the receiver and the battery pack by digging a cavity in the foam for each. Wilhold RC-56 glue toughens the sides of the servo cavities, and more clear tape secures each component.

The last step is to install control horns and build control linkages; this is carefully explained and diagrammed in the instruction manual. A good method of making "slipable" control pushrods with heat-shrink tubing is given.

Lou's Combat, with Futaba* S-148 and S-133 servos, a Futaba FP-R114H receiver and a 250mAh battery pack, weighs 12 ounces, ready to fly. With Airtronics* 94831 servos, an Airtronics 92245 receiver and a 270mAh battery pack, mine weighs 13 ounces.

Total cost to build two Combats is $59.95 for the kit, $16 for specified adhesives and about $4 for small hardware, dowels and heat-shrink tubing—about $80 per pair.



Here, radio gear is being positioned so that the Combat balances on pencil erasers placed at the suggested CG. Also shown to the left of the balance stand is a control-surface deflection gauge made from a graphic provided in the instruction manual.

FLYING

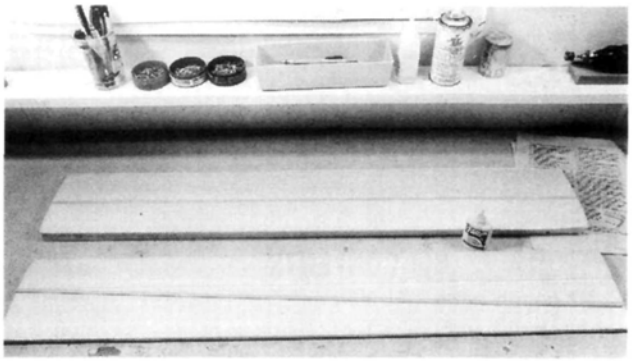
Launching is easy. A gentle shove into the slope lift, and the Combat is airborne. Roll sensitivity is radical—just about what you'd expect with a 27-inch wing with full-span, quarter-chord ailerons. The pilot quickly becomes accustomed to the rapid roll rate and soon comes to rely on it for maneuverability. Elevator sensitivity is similar to other small, 2-channel slope sailplanes.

After a few minutes spent getting used to the sensitive flight controls, the Combat becomes a blast to fly; it really scoots around the sky. Inverted flight is as easy as upright, with no loss of altitude, and rolls are blindingly fast, even from level flight.

On gentle inland and coastal hills, my Combat flew well in wind ranging from 10 to 20mph. Less than 10 may support the aircraft, but aerobatics are limited. More than 20, and you're fighting to keep the plane out in front of the hill and not really flying. The Combat needs a place for ballast to allow higher speed and better wind penetration.

The Combat's crash survivability is extremely high. It takes hard landings with a bounce, and it shrugs off cartwheel landings with maybe a crushed wingtip. It can slam into the ground inverted with no more damage than a detached fin. It smacks into trees with no more breakage than a dinged leading edge. The aircraft remains flyable through all this because even though foam is crushed to absorb landing injury, the tape wrapping keeps the pieces together and maintains the airplane's shape.

With CA glue, RTV silicone adhesive and a few more layers of tape, almost any crash damage can be fixed at the field and the model re-launched within minutes.



The wing is quickly constructed by gluing spruce spars into precut slots on the top and bottom of the wing-cores, then covering them with the clear specialty tape supplied in the kit.

Note, however, that although the Combat can be patched up, it can't be restored to original appearance and functioning like balsa or fiberglass models can. As it absorbs punishment, it gradually becomes a bag of Styrofoam crumbs.

With its high maneuverability and ability to absorb landing punishment, the Combat makes a worthy aerobatic trainer.

CONCLUSION

Anabats have the look and feel of disposable aircraft. Perhaps it's the Styrofoam construction material—the same stuff throwaway coffee cups are made of. By the time your foam servo-mount pockets have crumbled so that the servos no longer stay in place, you'll be ready for a replacement Combat. This isn't a serious fault, however, as during the life of the model you'll get plenty of flying and plenty of combat action. (I estimate it will withstand 30 or more crash landings, but nothing is guaranteed.) This fun and function come at an inexpensive price and low building time. Remember, you get two planes for about the price of one with this kit, and they can be ready to fly after six hours on the bench. The Anabat Combats are the "fun-fly" planes of the slope—weird-looking, slow-flying, wildly maneuverable and always ready for competition.

**Here are the addresses of the companies mentioned in this article:*
Anabatic Products, *411 Beach Park Blvd., Foster City, CA 94404; (800) 573-9363; fax (415) 573-1585.*
Futaba Corp. of America, *4 Studebaker, Irvine, CA 92718.*
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MODEL AIRPLANE NEWS MAGAZINE
FIELD & BENCH REVIEW

Byron Originals SUKHOI 26

by MIKE LEE

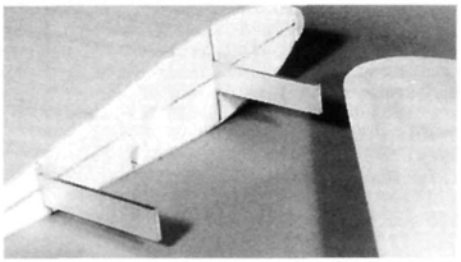
SOME OF THE most famous aerobatic birds the world has known have been products of Europe or North America. Classics such as the Pitts Special, the Chipmunk, the Zlin Akrobat and the Laser are well known to the modeling world as well. A few years back, the Russians made a big step forward with an aircraft that was against the current aircraft design norm when they introduced the Sukhoi 26m.

Because these aircraft have been exposed to millions of people at air demonstrations and competitions, the modeling world has grown very fond of the new Sukhoi very quickly. In fact, there are already a half a dozen or so examples of the Sukhoi available to the modeling public. The subject of this review is the second version from a leader in scale aerobatic birds—the Byron Originals .60 Sukhoi 26m.*

Byron has had a large version of the Sukhoi available for the past couple of years, and the company has enjoyed considerable success with it. But there was a significant number of calls requesting a smaller version—just for the normal sport-minded pilots. Fact of the matter is, more pilots fly aircraft in the .40 to .61 range than all other sizes combined. Byron met the opportunity head-on with this smaller version that features everything its larger brother has, but in a smaller package. Nothing has been left out.

PHOTOS BY MIKE LEE

Success in a .60 size



The sheeted wings with wing joiners are ready for the endcap rib. Both wings are plugged into the fuselage and cinched down by Allen-head bolts. The fit was almost exact.

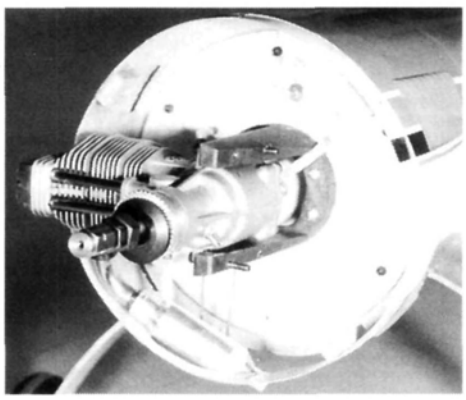
KIT CONTENTS

Byron kits are touted as being "complete kits," including the hardware, the fuel tank, the engine mount and other items. I've built a lot of different kits, but this is one of the most complete hardware packages I have seen to date. Everything was there, including wheels, a fuel tank with tubing, axles, pushrods—the works. You'll need a radio, an engine, a prop, paint and adhesives. But hardly, if anything, more. Kudos to these guys. I hate spending time running to the shop for penny-ante parts that cost less than the gas I burn to get them.

The airframe kit consists of a resin/fiberglass fuselage, foam-core wings with sheeting, built-up balsa tail feathers and plywood parts for the heavily stressed areas of the airframe. Everything arrived undamaged in one box after receiving the "Samsonite luggage test" by UPS. A fully detailed instruction manual with illustrations accompany numerous drawings, templates and views for the construction of the aircraft. No full-size blueprints of the entire aircraft are given, but you won't need them. The drawings, templates and the manual complement one another well for a complete assembly guide.

CONSTRUCTION

The Sukhoi's fuselage is a large fiberglass unit that occupies most of the space in the box. Be careful when handling the fuselage, as the seams and edges are very sharp. After cutting a finger immediately upon grabbing the fuselage, the first thing I did was to knock off the seams and edges with a couple of quick swipes with 220-grit sandpaper. This led to a surprise: the sanding dust revealed nicely detailed panel lines and louvers on the surface of the fuselage.



The business end of the Sukhoi with the O.S. 120 Surpass in place. Note the arrangement of the exhaust pipe. This is a powerful package for all-out flying.

The wings are basic foam-cores with balsa sheeting. The wing mounting blades are glued to plywood reinforcements at this time and are glued to the foam-cores. The wing sheeting can now be glued to the foam-cores in whichever fashion you desire. Be sure you sand the surface of the foam-cores to achieve a smooth surface for the adhesive to mate with. Note that you will also cut out a space in the core for the servo pocket in the wing. A template is provided to allow a precise placement of the pocket. Holes for the servo wires have already been drilled into the cores. I used long-set epoxy for the wing skins; this resulted in great adhesion and fairly light weight.

When the sheeting has cured, the leading- and trailing-edge stock is attached, followed by the aileron stock and wingtip blocks. Nothing fancy about this wing job. However, when mating the wings to the fuselage for the initial fitting, I was pleased that the wings mated almost exactly with the wing fillet on the fuselage!

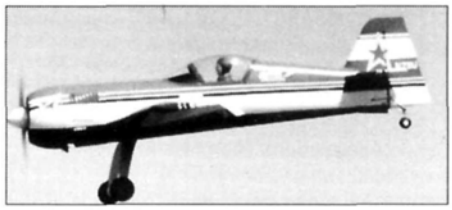
Moving to the tail feathers, I found that the horizontal and vertical stabilizers are built-up balsa units with balsa sheeting over them.

FLIGHT PERFORMANCE

• Takeoff and Landing

Upon opening up the Surpass's throttle, the torque will immediately show up as a left turn as it starts to roll. A bit of right rudder will correct this, but don't overdo it. Although the rudder throw is not much, it is quite effective. As the bird picks up speed, it will not bring up the tail unless you bring it up with a bit of down-elevator. Nonetheless, the Sukhoi will rise off nicely, with or without the tail flying, in about 100 feet. It shows no tendency to nose over whatsoever. When it's airborne, give it a couple of seconds to unload, and you can point it to the wild blue yonder.

Landing the Sukhoi was a big surprise. This Sukhoi has a very short tail moment, which can lead to some "squirrelly," even snap-prone tendencies, even when you don't want it. In this aircraft, such is not the case. After you've set it up on the landing approach, you can take a fairly normal approach—equal to any sporting aircraft. It seems to simply ease downward, and on flaring for the touchdown, the Sukhoi will slide right along the surface for a very docile landing. It displayed no bad habits and not a hint of snapping over. It will help to grease the plane in, as it can begin the dreaded landing bounce if you drop it too hard.



• High-speed Handling

High-speed flight is where the Sukhoi comes into its element. With the O.S. 120 Surpass for power, the Sukhoi has no need for more power. It can climb straight up on a 13x10 APC prop and go out of sight; it just keeps chugging. There's no need to change trim going from low throttle to high throttle.

Yanking the Sukhoi around the sky at high speeds produces fantastic, scale-like stall maneuvers. The short tail moment had me switching in and out of the dual rates, as I found the elevator very responsive. Amazingly enough, with the rudder having a very modest amount of throw, its authority is very high, providing good yaw control. I found that the Sukhoi will perform a high-speed stall if tight pylon turns at full throttle are attempted, but this design wasn't meant for such antics in the first place.

• Low-speed Handling

The Sukhoi is quite docile at lower speeds. It doesn't slow down quickly, despite the fact that it has the larger radial cowl. During the turn to final approach, it will pay to watch the bird closely, as the Sukhoi will pick up some speed here. Although it doesn't have any low-speed snap-rolling tendencies, you're well advised to maintain a reasonable angle of attack until it's time to flare out.

Low-speed stalls will require some piloting skills, as the Sukhoi will sucker you in with its ability to fly very slowly. When it finally does stall, it will break off quickly and will require a good 50 feet of altitude to begin the recovery process. Don't forget, this is a 9.5-pound bird.

Dead-stick behavior is very similar to low-throttle behavior.

• Aerobatics

This is what the Sukhoi was designed to do best, and it delivers. Rolling maneuvers are clean, with about 1¼ rolls per second. With the CG placed according to the plans, inverted flight requires a generous amount of down-elevator input. I backed up the CG by ¼ inch, and the required down-pressure was eased quite a bit. Point rolls are very nice, and the rudder is able to hold a knife-edge position for long periods. I didn't notice any adverse rolling with the application of rudder. Snap rolls are controllable and immediate, and the Sukhoi does one of the easiest stall turns in the business.

Looping maneuvers are easy, but the short profile of the Sukhoi can be deceiving to the pilot. It took another pair of eyes to tell me that the aircraft was tracking correctly. Again, the use of dual rates on the elevator will help, owing to the sensitive nature of the elevator. Overall, the Sukhoi can be a strong performer for aerobatics work, and it should adapt well to scale competition, where its stunt capability will be an asset to its scale looks.

SPECIFICATIONS

Model name: Sukhoi 26m (.60 size)
Manufacturer: Byron Originals
Type: Scale aerobatics
List price: $290
Wingspan: 62 in.
Wing area: 736 sq. in.
Wing loading: 30.52 oz./sq. ft.
Length: 52 in.
Engine used: O.S. Max 120 Surpass 4-stroke
No. of channels req'd: 4
Radio used: Ace MicroPro, RCD receiver, Futaba servo
Prop used: APC* 13x10
Airfoil type: Symmetrical
Washout built in? Yes
Wing construction: Foam-cores, balsa sheeting
Kit construction: Fiberglass fuselage, wooden tail surfaces (balsa)
Optional accessories used: McDaniel R/C remote glow-head adapter

Features: the most complete hardware package in town; good detailing on the fiberglass surface; good scale rendition and top-quality kit parts.

Hits
- Excellent kit with complete hardware outfit.
- All parts fit correctly.
- An attractive, excellent flier.

Misses
- Two areas in plans are incorrect, but minor.
- Rudder throw is restricted.
- Must have cheater hole in cowl for cooling air.

This makes for very strong, but light, components. Again, nothing fancy about the construction. You cut and butt the parts to make both assemblies. Templates are provided to allow exact cutting of the difficult parts. I used a shot of spray adhesive to the back of the templates to temporarily stick them to the balsa stock, and then I cut out the part on the scroll saw; makes life simple.

I did notice an error in this area of the construction. The plans show parts E-1 and E-2 in their proper positions on the stab/elevator assembly. However, you won't find template E-1. Instead, you'll find templates E-2 and E-3. Just ignore the template numbers and put the parts where the plans show. You'll do just fine.

You may also want to alter the rudder just a shade. The leading-edge stock of the rudder is made of two parts, making the thickness of the leading edge 3/8 inch. You'll also notice that the leading edge is also very wide. This means that the rudder can't be chamfered very much at the leading edge, thus restricting the amount of rudder movement at the hinge line. My suggestion is to add another 1/4 inch of balsa to the leading edge, allowing a sharper degree of chamfer for the hinge line and thus more rudder throw. The additional thickness won't really hurt you. Remember, it's easier to remove material than it is to add material later on.

When the tail feathers have been completed, attention can be turned to the fuselage. Start by cutting the various slots and holes for the wings, stab, landing gear and other sundry items. Take your time, and use the templates. They'll guide you to perfectly cut holes that are exactly where they need to be. Now, mount the formers on the fuselage. It was here that I ran into another small problem.

The completed tail feathers are a good match with the fuselage of the Sukhoi. Note the large area for both rudder and elevators.

The plans show former F-5 in the incorrect position when compared with the instruction manual. The photos in the manual indicate that F-5 will sit behind the wing mounting rails. The plans show F-5 forward of the rails. It was my belief that the F-5 former should be behind the rails, and that is how I made the assembly.

Virtually everything that's glued to the inside of the fuselage must be epoxied into place. This is further reinforced with the addition of fiberglass cloth strips to stave off cracks from forming in the high-stress areas. I went one step further when it came down to the firewall. I cut the edging off a piece of 6-ounce cloth, leaving a pile of 1/2-inch-long individual fibers of cloth. This was mixed in with the epoxy and then poured around the firewall ring. The result was a very strong joint without the bother of reaching into the fuselage from behind and placing the cloth strips into the wet epoxy.

At the same time that you install formers F-4 and F-5, you'll also place the wing mounting rails on the formers. Take your time here, as you must do this correctly to ensure that the wings mate evenly with the fuselage. Once it has been done, there is no turning back. Former F-4 also is the rear brace for the main landing-gear blocks, so it's easy to see how one screw-up can produce a domino effect. It's not hard, just take your time.

At the firewall, you'll need to decide which engine will be used to power the model. The kit recommends a .61 2-stroke or a 120 4-stroke engine. If you need to keep the bird absolutely scale, use a 2-stroke. The .61 2-stroker will fit completely under the cowl, including the glow plug. I decided to use a 4-stroke O.S.* Max 120 Surpass engine and was forced to open up a hole on the side of the cowl to allow the head of the engine to poke through (a bit more on this later).

The firewall is unique in that it's actually a two-part affair with an outer mounting ring and the inner firewall. The mounting ring is epoxied to the fuselage permanently, and the inner firewall sits flat on the ring and is bolted to it. This allows you to place the engine and fuel tank next to the firewall—making the firewall a removable power unit. You could actually make several firewalls and exchange engines all day long! This also allows easy access to the fuel tank if you need to service it.

So far, so good. Now, move to installing the tail feathers. Nothing new here; just make sure the alignment is correct before you let the epoxy set. A nice steerable tailwheel assembly comes with the kit, and it's as good as they come. From here, just tidy up a few minor points and you're ready for finishing.

FINISHING

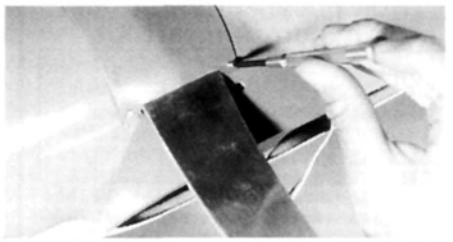
My Sukhoi was finished using a matched finishing system by Top Flite*. The wings and stab of the Sukhoi were covered with Super MonoKote* film. Recently, Top Flite introduced LusterKote to provide a color matched finishing system for models. OK, I'll try anything once. The results were superb. LusterKote handles quite well, especially considering it's from a spray can. The colors match, the surface of the paint is uniform and the adhesion was good.

Additional decoration of the plane was from the included decals. You can make several versions of the basic design. My version was copied from a set of documentation pho-

tos from Scale Model Research*. These guys have almost a dozen different Sukhoi versions on hand at reasonable prices (well worth the cost).

POWER

The engine I used, as mentioned earlier, was the O.S. Max 120 Surpass. This isn't a new product, but it has earned a good reputation for itself. If you use an engine of this size, you'll have to be prepared for a couple of things. First, the head of the engine will poke out of the cowl. If you're a scale buff, this will bother you. Next, the amount of cooling air that can pass through the cowl and exit it



A small hatch covers the landing-gear blocks and maintains the scale look of the Sukhoi.

is greatly restricted. A 2-stroke engine installation may be able to get away with opening up the scale engine louvers for hot air exhaust. With the 120 engine, I had to make an engine baffle to direct the flow of air over the engine only. I then opened up as many louvers as I could for air exhaust, but this wasn't enough. Finally, much to my dismay, I had to open up a cheater hole on the bottom of the cowl to allow sufficient air exhaust.

By the way, if you use the O.S. Max 120 Surpass, which is a delightful engine, the exhaust pipe will be right where the scale air scoop will be placed. For looks, I place the air scoop on the model, but for flying, the scoop must be removed, or it will definitely be destroyed. I also used a McDaniel R/C* remote glow-plug adapter to avoid having to punch an additional hole in the cowl for glow-plug access. I simply route the wire from the adapter to the bottom of the cowl—inside the cheater hole where you can't see it. You've gotta try this.

The radio I used is the Ace* MicroPro 8000 system, mated with an RCD* platinum receiver and Futaba* servos. This is a great combination of radio components that works well. Installation is no problem, as you can simply drop the components into the plane. There are five servos in the ship, and two of them are used in the wings. A 1000mAh battery provides an extra margin of safety.

I did take one liberty with the radio installation. The instructions call for the aileron servos to be installed into flat servo trays glued into the wing. This leaves the whole servo sticking out in the breeze, and although you see a lot of planes this way, it wasn't for me. Instead, I used a 1/16-inch-thick square

(Continued on page 78)

HOW TO

Build Functional Leading-Edge Flaps

by MONT J. CARTWRIGHT

Larry Wolfe, owner of Jet Hangar Hobbies, demonstrates the actuation of leading-edge flaps on a Jet Hangar F9F Panther.

EXPAND THE PERFORMANCE ENVELOPE

LEADING-EDGE DEVICES (LEDs), such as slots, slats and leading-edge flaps are used in full-size jet aircraft to improve their flight characteristics at low speeds. In this article, I will explain how I made functioning leading-edge flaps for my Jet Hangar Hobbies* Grumman F9F-4/5 Panther. The Panther utilizes relatively simple leading-edge flaps in conjunction with wing and body flaps to generate maximum lift at low speeds. No additional servos are required, and the weight gain from the leading-edge flaps is minimal. There are real flying benefits, too: with leading- and trailing-edge flaps deployed, my Panther can be slowed down to about 20mph during a landing approach; takeoff speed can also be reduced.

This leading-edge flap design is a fairly simple one that can be readily adapted for use on any applicable scale or sport aircraft. At the outset, I'd like to offer special thanks to Larry Wolfe of Jet Hangar Hobbies for his expert advice, which was invaluable in the preparation of this article.

ABOUT LEDS

LEDs are employed on various aircraft, including commercial airliners and military jet fighters. They alter the wing's lift characteristics by varying the wing's camber. When deployed, they generate both lift and induced drag. This requires that power be added to compensate for the drag.

In a leading-edge flap, a section of the leading edge is hinged. When the flap is deployed, the leading edge of the wing moves both downward and forward (droops). Deployment of the leading-edge flap does not result in a slot or other gap at the leading edge.

Leading-edge flaps should be distinguished from slats. Slats move outward from the wing on arched tracks, thereby creating a slot between the slat and the wing. A deployed slat in effect creates a double leading edge.

FLAP MECHANICS

My design goal was to accurately reproduce the scale appearance of leading-edge flaps used on full-size aircraft. To maintain good wing aerodynamics, deployment of the flaps must not produce a gap on the upper

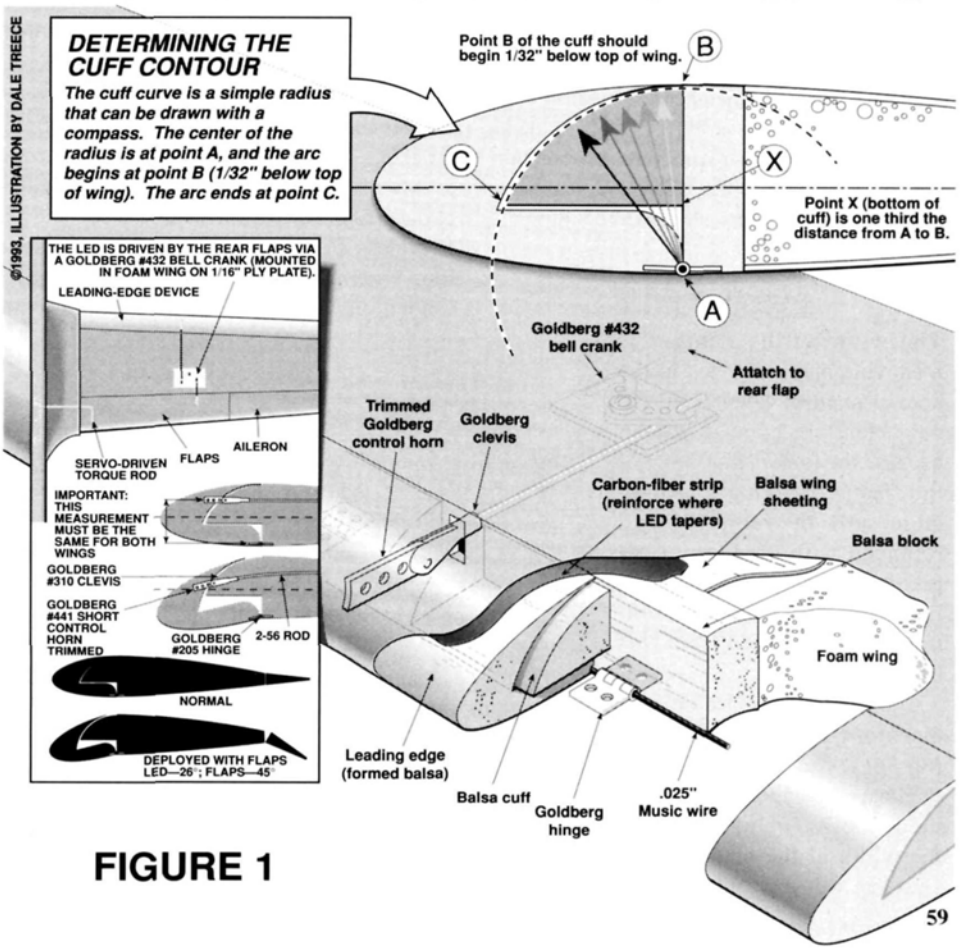


FIGURE 1

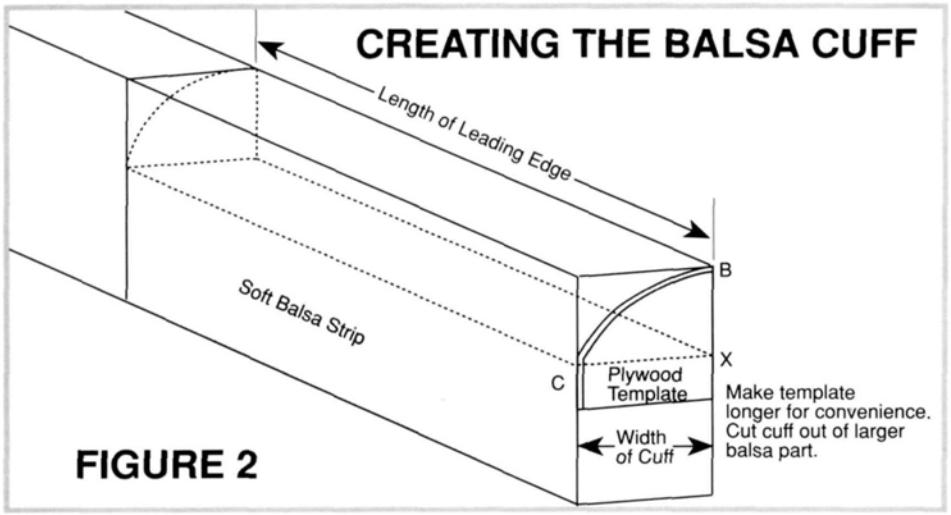


FIGURE 2

wing surface. These objectives can be met using simple foam and balsa construction techniques that I will discuss below.

No gap occurs with this design because the top, aft edge of the leading-edge flap slides forward and downward along a smooth, contoured surface as the flap is deployed. This surface is the top of an inner balsa cuff that is attached to the *faced* leading edge of the foam wing just behind the flap. When the flap is retracted, the cuff mates to its concave inner surface. When the flap is deployed, the cuff is exposed, bridging the potential gap and space.

The smooth actuation of this flap mechanism is allowed by the geometry of the flap's hinge point. The aft, top edge of the flap and the curvature of the cuff along which it slides are both equidistant from the hinge point as the flap rotates through its arc.

The key to proper function and scale appearance is to shape the cuff's outer surface so it precisely matches the leading-edge flap's inner surface as the LED pivots at its hinge point. It is also important to maintain adequate strength in the LED's trailing edge, as it must be kept very sharp. Here's how it's done.

INSTALLATION

The wing on the Panther is foam-core and is sheeted in the normal manner. Don't sand the balsa leading edge to shape, because the first inch or more of the foam-core wing's leading edge will be removed and replaced with an appropriate piece of balsa stock. The leading-edge flap mechanics will then be constructed from this balsa facing.

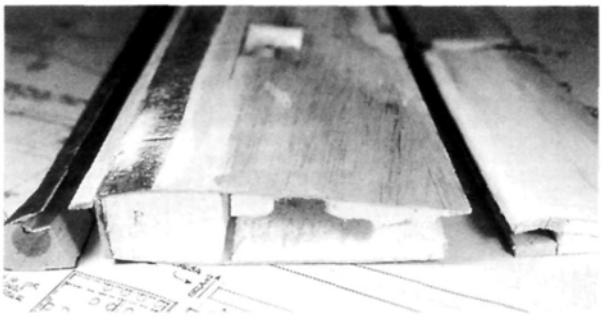
First, you must decide how much of the foam wing's leading edge you wish to replace with balsa. Using accurate three-view documentation, estimate the width of the leading-edge strip that will form the flap, and mark the flap outline on the foam wing's surface. Make the actual cut line ½ inch aft of the flap's trailing-edge line. You need the extra ½ inch of balsa facing, because this is the structure that will anchor the flap hinges and add strength to the cut area of the wing.

Next, glue a solid block of balsa along the entire leading-edge area forward of the cut line. Now it is time to sand the exterior of the wing's leading edge—including the area that will be the outer surface of the retracted flaps—to its final contour. At this stage, glue a wide strip of .2-ounce carbon fiber to the wing's upper and lower leading-edge surfaces. The strip should run lengthwise between root and tip, and it should overlap by ½ inch or so the line that marks the trailing edge of the retracted leading-edge flap. Thus, the carbon-fiber strip bridges the line that separates the wing from the flap.

After sanding the wing and smoothing the carbon-fiber strips, the wing is covered in fiberglass cloth and resin in the usual fashion. When the resin has set and you have sanded the fiberglass cloth, again draw the line on the wing that marks the trailing edge of the retracted flap. Cut along this line cleanly through the leading edge so as to separate the flap from the wing. A fine-tooth Zona razor is used to make a precise and straight separation line. With the wood that will become the flap temporarily removed, the wing will have a balsa face along its leading edge approximately ½ inch thick.

FORMING THE CUFF

Figure 1 shows the geometry of the leading-edge flap. Line A-B marks the leading-edge face of the wing and the trailing edge of the flap. "A" at the bottom is the pivot point of the hinges that connect the flap to the wing. (Note the hinge is flush with the bottom edge of the wing). The convex surface, or face of the cuff, is a compass arc with the radius point located at point A. The arc line is positioned 1/32 inch below point B, and the arc drawn to point C.


Detail of a prototype leading-edge flap design. Note the small size of the cuff compared to the illustration.

Line C-X is drawn 90 degrees to line A-B. Line B-X extends two thirds of the distance from point B to point A. It's a good idea to make a plywood template that represents this shape.

Form the cuff from a piece of balsa stock that is the length of the flap and as wide as the distance C-X (see Figure 2). Plane the upper surface of the cuff, sand it smooth, and then finish this surface with ¾-ounce glass and resin. Then prime and sand it again, before cutting the cuff away from the balsa stock. Cut the cuff away from the stock along the C-X line, and glue the cuff to the wing's leading-edge facing. Notice that the top of the cuff is positioned 1/32 inch below the surface of the wing to make room for the trailing edge of the flap.

FORMING THE LED

Using the cuff template, mark the ends of the balsa leading-edge flap stock to mark the inner surface of the flap. Using a coping saw, cut out the inner surface of the flap that fits over the cuff.

LEDS USED IN FIGHTERS

The first American jet to employ leading-edge slats was the F-86 Sabre. Gravity caused them to slide out of the wing at flight speeds, and air pressure forced them into the wing. Eventually, they were bolted up, as they tended to deploy at lower air speeds (which could cause control problems in a combat environment). On the other hand, the F-4 Phantom used a complex leading-edge configuration. The Air Force versions used a six-piece leading-edge flap that came down at 30 degrees, 55 degrees, and 60 degrees while the trailing-edge wing flap deployed at 30 and 60 degrees. However, other F-4 versions used both flaps and slats. It is interesting to note that the F-14 Tomcat is the only jet fighter still in service that employs leading-edge slats. All other current fighters use leading-edge flaps, except the F-15 Eagle, which has no leading-edge devices.

This cutout should be made oversize to allow for its inner surface to be finished with cloth and resin just as the outer surface of the cuff was.

Note that the carbon-fiber strip that was earlier glued to the upper surface forms a very strong and thin flap trailing edge. When the inner surface of the flap has been dug out and fiberglassed, the lower trailing edge can be hinged to the fixed leading edge of the wing. A hinge with a removable pin, such as a Klett, is essential if you want the flap to be removable for maintenance. All the hinges can be pinned with a single piece of .025-inch-diameter music wire, thus keeping all the hinges in line as well as filling the minor gap at the hinge line. By removing this single wire, the entire flap is easily removed.

ACTUATION

The flap is actuated by an internal 2-56 pushrod that's attached via a clevis to a cut-down Carl Goldberg* no. 441 short control horn. The horn is embedded in the cutout area of the leading-edge flap and glued in place (see Figure 1). A hole in the wing's faced leading edge allows the pushrod to pass through and be connected to the flap. The leading-edge flap is coupled to a wing flap via a Goldberg no. 432 bellcrank mounted in the foam wing on a 1/16-inch plywood plate.

When the wing flap is lowered, the aft pushrod pulls on the bellcrank which, in turn, extends the leading-edge flap. By using various hole locations in the mid-wing bellcrank, you can adjust the amount of travel you get from the LED in relationship to the wing-flap travel. On my model, the leading-edge flaps are positioned 3/8 inch forward from the upper wing surface when the wing flaps are in their fully deployed position of 45 degrees. That's about 26 degrees deflection for the leading-edge flap.

Remember to mount the clevis anchors in exactly the same position relative to the hinge lines on both leading-edge flaps. This is necessary to ensure the same amount of throw. For safe and proper use, both leading-edge flaps must move exactly the same distance and at the same rate (if not, unwanted roll will occur because of the difference in lift and drag produced by each wing half).

CONCLUSION

When you have finished, you'll have a functional, scale-like leading-edge flap that is activated when you lower your wing flaps. The enhancements to slow-speed flight performance will be well worth the extra effort.

**Here are the addresses of the companies mentioned in this article:*
Jet Hangar Hobbies, *12130 G. Carson St., Hawaiian Gardens, CA 90716.*
Carl Goldberg Models, *4734 W. Chicago Ave., Chicago, IL 60651.* ■

SIMPLE PROGRAMMING

DAVID C. BARON

LETTERS OF INTEREST

THIS MONTH, I'll answer a few letters that raise questions that seem to come up time and again. These letters relate to the use of flaperons on aircraft equipped with strip ailerons (and two aileron servos); whether to use 4- or 5-cell airborne battery packs; and changing model memories in the Futaba 7UAFS radio.

FLAPERON HINTS

I read with interest your article on flaperon programming in the October '93 issue. I have a Futaba* 7UAFS FM radio. In your article, you mention the basics of programming the PCM equivalent of my radio. I'm assuming that you would activate the "FLAP" part of the flaperons with the flap trim knob. I thought it would be nice to be able to activate the flaps with a switch instead. After some experimentation, I did discover a way to do this. Here's how it is done:

- **1.** Set FLPR function to "on," and set the percentages to +100 percent.
- **2.** Set FLTR function to "on," and set the percentages to 0 percent.
- **3.** Set ABRK function to channel 1 and 6 to the desired amount of flap. These should be set to minus percentages.

[Author's note: This may not always be the case, depending on the type of servo and pushrod installation.]

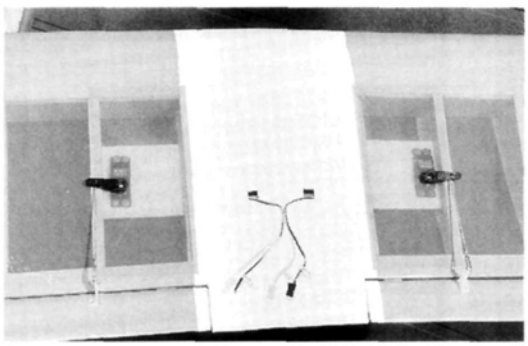
You can also mix in a desired amount of elevator trim on channel 2; otherwise, channel 2 should be set to 0 percent and channel 3 set to "off."

Once these are set, you should be able to activate the flaps with the 2-6 mix switch.

Larry DeBoer, Tyler, MN

Thank you, Larry; there is no end to what we can figure out if we look at what we have to work with and do a bit of tinkering.

To expand on Larry's idea, there is a little-used feature buried in the ABRK function of the 7UAPS. This is the auto mode for channel 3. It requires all that is mentioned above, and the 2-6 mix switch needs to be in the down position (the 6-2 position). You will be turning channel 3 to on, or "+." This will allow you to have your throttle-stick position actuate your spoiler or your flaps. You'll also have to set up the amount of throw of each flaperon. Remember, this will only work when you put switch 7 in the 6-2 (down) position. This feature also gives the user the ability to re-trim the elevator when the flaps or spoilers are deployed. You will always need to fly the plane first to know how much trim and in which direction it is needed.



If your ailerons are controlled by two servos, flaperons are simple and easy to set up with a programmable radio.

4.8 OR 6 VOLTS?

I was discussing with some of the club members here in Albany, NY, whether or not to use a 6V receiver battery pack in a plane. I'd like to, because I have nine servos in my plane and maybe lights. Is six volts too high? Why or why not? Can I also use the six volts for my lights?

Robert Kibbey, Albany, NY

Bob, I am a big fan of using 6V packs in large planes as well as in planes with many servos, as yours seems to have. There are many things that will drag down the voltage in your battery pack: long leads, stiff and high friction pushrods, having nine servos.... When the batteries are experiencing a load, you will suffer a drop in system voltage. With enough load, this can become critical. I remember one of my first large fun-fly aircraft; its radio would automatically drop the throttle if a circuit in the receiver sensed the voltage dropping below 3.6 volts. Every time I did a set of full-throttle, elevator-flap coupled loops, the throttle dropped to idle! I was using a 4.8V 270mAh battery pack. When I landed and checked the batteries, they would read over 4.8 volts under load, but obviously not as much load as two flap servos and one elevator servo operating at full deflection and full throttle! The difference between this and a 6V system is more than just higher voltage. The key is that you have more wattage available to your servos. Since watts are measured as volts multiplied by amps, you can see how much more power would have been available if I had used a 6V pack.

- **5-CELL PACK:**
  6 volts x 270mAh = 1.62 watts
- **4-CELL PACK:**
  4.8 volts x 270mAh = 1.296 watts

You will therefore gain in two areas by switching to an extra cell; your servos will have more power because they'll be getting more power from their source (the battery), and you will also get more speed. The speed comes from the motor in the servo running at higher rpm owing to the system's higher voltage. One caution: you will rarely get

more duration, and duration may, in fact, suffer. I like to fly only a few flights on a new system, and then I cycle the airborne pack to determine how many more flights I could have flown before running the batteries to the limit. Use care when testing a 6V battery with a commercially available expanded-scale voltmeter. They are usually calibrated to test only 4.8V packs.

Regarding the addition of lights to your aircraft's power system, I prefer to use a separate power system for additional systems that do not contribute to flight controls. All it takes is a little bit of chafing in the wiring to create a short circuit and reduce your favorite plane to rubble. There are many good systems on the market that will turn on a separate power system for applications such as on-board ignition systems, and any of these could be easily modified to the task you have in mind. They would also offer safe isolation of your non-critical circuits.

7UAFS MODEL MEMORIES

I have a Futaba FP-7UAFS radio. With help, I set it up in a Foxbat and have had excellent results. Now I want to add another plane (a Wild Thing) with aileron, elevator and rudder. The manual that came with the radio has not been a terrific help. (I have to get my grandson to set the time on my VCR.) I do have a limited knowledge of using a PC.

You published an article on the JR 388 and also one on the new 9-channel Futaba 9ZAP. Do you have similar simplified instructions for the Futaba 7UAFS, or can you tell me where I might find them?

Jerry Colvin Jr., Valley Lee, MD

Jerry, quite a few readers have written to request more information on 7-channel Futaba radios. The December 1992 column is titled "Fun-Fly Mixes," but it is full of hints and ideas that are centered on the 7-channel Futaba. Also, the May 1993 issue has the Futaba 7UAPS Pocket Reference Guide. This card packs a manual of information into a card for your flight box.

The audible Crash Alarm from Cadmatics* will help you find a downed plane. Note that the system is powered by a separate battery, not by the flight pack.

Your question about changing to a new aircraft memory may be answered as follows:

Enter the edit mode by depressing both edit keys simultaneously.

- **1.** Using either of the "+" or "-" edit keys, scroll through the menu until you get to the function titled "SEL."
- **2.** Use the cursor keys to select a different model memory. Notice that they are numbered 1 through 4. (I have found—the hard way—that it is very desirable to put this number on your airplane!)
- **3.** If this is a previously unused memory, you will need to set up all the relevant controls.

That's all I'm allowed space for; keep those questions coming!

**Here are the addresses of the companies mentioned in this article:*
Futaba Corp. of America, *4 Studebaker, Irvine, CA 92718.*
Cadmatics, *21941 Ybarra Rd., Woodland Hills, CA 91364.* ■

Left, top to bottom: in spite of the SR-71's age, it still looks ominous! Twin Dynamax fans power this scratch-built Blackbird, built by Lowell Wexler. It has full cockpits and operating landing/taxi lights.

• Mike Kulczyk and his latest, scratch-built, scale, IMAA-legal, giant jet—the Republic F-84G Thunderjet.

• The formation flying team of Tom Dodgen and Gus Hudson with their BVM F-86s. Their precision formation landings must be seen to be appreciated. The colorful markings are produced by Aeroloft Designs.

• This spectacular four-engine Convair B-58 Hustler was the star of the show and recipient of the Model Airplane News Technical Achievement Award. This is the second Convair produced by the Lynn McCauley team and the first to be flown at the SWFF.

• Tom Robertson's outstanding F-16. Tom received the "Best F-16 Award" from the pilots who fly full-scale Texas Air Force Reserve F-16s from the 924th TFG.

South

A glimpse into

by RICH URAVITCH

MODEL AIRPLANE NEWS TECHNICAL ACHIEVEMENT AWARD

LET'S SUPPOSE, JUST for a minute, that you were a ducted-fan enthusiast and you could only get to one, or with luck, two ducted-fan meets in a season. Naturally, you'd want to get the most bang for the buck and see the newest, biggest, fastest, slowest and most unusual R/C ducted-fan airplanes around. Throw in the opportunity to socialize with the "names" in the hobby and to have nearly every ducted-fan question you ever had answered accurately by expert modelers who have been confronted by similar problems. Where is this jet-modeling mecca—this revered institute of

Bob Thacker ("Colonel" to his subordinates) brought his foam and wood, 1/4-scale BD-10 to the event.

Here are just some of the Bob Violett Models kits at the event. Seven of the kits are Mavericks—BVM's newest release.

11th Annual Greater Southwest Fan Fly

The future?

Bob Violett's T-33 climbs out as the back-seater keeps a watchful eye on the cameraman. These large jets look remarkably realistic!

higher learning from which everyone leaves much smarter on jet matters than when they arrived? One of them, without doubt, is the Greater Southwest Fan Fly that's held every September in the great state of Texas.

This event has been going on for 11 years and has evolved into one of the "must attend" events in the U.S. fan-modeling world. The recently deactivated Bergstrom Air Force Base in Austin served as this year's site, and it provided nearly wall-to-wall concrete from which all R/C flights departed and most returned. You couldn't have asked for better.

Much of the credit for the success of this year's event goes to a variety of hobby-industry sponsors, who picked up the tab for the plentiful prizes, and to CD Rick Schafer and members of the Austin R/C Association (ARCA), who provided the organization and manpower to run the event.

(Continued on page 71)

One of four A-7 Corsair IIs from E.T.A. Models, this one is an Air Force D model. Its fiberglass fuselage, foam wings and tail make it a simple structure. It flew convincingly on Byrojet power.

PHOTOS BY RICH URAVITCH

MISSED OPPORTUNITIES

What did you miss if you weren't in attendance? A lot! Eighty-seven fliers brought more than 100 jet models of all types, including sport and scale, twins, 1/4-scale and true turbine-powered models. I don't know if anyone kept an actual count of the sorties, but there were very few times throughout the three-day event that at least two jets weren't airborne! There were many impressive models on hand—some of them nothing short of spectacular. Of these, one that still rose above the rest was the incredible Convair B-58 Hustler designed and built by Lynn McCauley and his team that included Butch Sichels, Charlie Fondon and Lee Rice. Lee also handled the piloting responsibilities. The complexity of this '50's-vintage, four-engine jet bomber model is mind-boggling. Just its physical size is overwhelming. This beauty is 126 inches long, spans 76 inches and weighs 50 pounds at takeoff! The 26 pounds of static thrust generated by its four O.S.* .46s driving Viojett* rotors provided more than enough power for its very scale-like flight. Rest assured that when the four engines were running and Lee Rice taxied out for take-off, he owned the field! Everyone watched as the big delta accelerated, rotated and ran on the main gear for about 100 feet before climbing gradually to the right as the scale gear tucked itself away into the wells. A few passes down the runway and Lee set up for a landing that could have been taken directly from the B-58 flight manual. A huge cheer went up as the drag chute was deployed, and Lynn's team breathed a collective sigh of relief as the Hustler was taxied back to the pits past the applauding crowd.

If no other airplane flew that weekend, witnessing that flight would have been enough for me. It sure wasn't the only spectacular flight, however; Kent Nogy's JPX* turbine-powered BVM Viper was impressive in a different way. Gone was the scream of the high-revving glow engine. Replacing it was the whine of the turbine and the "whoosh" of the airframe as the Viper streaked by at more than 200mph! Plans are now being made under the direction of the Bob Violett organization to develop

AWARDS

AWARD	RECIPIENT	MODEL	SPONSOR
Best Performance First Jet	Mike Goolsbee	JHH A-4	JPO*
Craftsmanship	Mike Kulczyk	F-84G	Dry-Set Markings
Technical Achievement	Lynn McCauley	B-58	Model Airplane News
Technical Achievement	Kent Nogy	Turbo Viper	Custom Model Products
Best Sport Finish	Jerry Caudle	Maverick	ARCA**
Best Scale Finish	Tom Robertson	F-16	ARCA
Best Freestyle Performance	Mike Stokes	Maverick	ARCA
Best Scale Flight	Carl Spurlock	F-20	ARCA
Target Speed (27 for 29mph)	Eldon Bennett	F-89	ARCA
Fastest Jet (220mph)	Chris Huhn	Aggressor	ARCA
Critic's Choice	Todd Nicholson	MiG-29A	Power Master Fuel
Pilot's Choice	Lynn McCauley	B-58	ARCA
Best F-16 Model TFG	Tom Robertson	F-16	924th

* Jet Pilot's Organization
** Austin Radio Control Association

Kent Nogy and crew fire up the Turbo Viper for a demo flight. The JPX unit is a French design, and it will be marketed here by BVM.

Bob Fiorenze's Lockheed F-117A taxies back with drag chute deployed after another successful mission. The twin Dynamax fans with their O.S. .91s were reliable and realistic.

This MiG-21 designed and built by John Carlson seemed a little underpowered. John also brought a Saab J35 Draken.

Carl Spurlock is literally a one-man air force with his fleet of Byron Originals jets. All of them were flown almost continuously throughout the event.

This giant-scale, IMAA-legal, Grumman F9F Panther was built from Ziroli plans by long-time scale builder Norm Berger. It sports a fiberglass fuselage, built-up flying surfaces and a scale cockpit. A single Dynamax fan driven by an O.S. .91 flew this 21½-pounder!*

The Model Airplane News Technical Achievement Award is presented to Lynn McCauley (center) and team member Charlie Fondon (right) for the incredible B-58 Hustler. Butch Sichels, the third member of the team, left early to finish work on his new (and huge) KC-10 tanker!

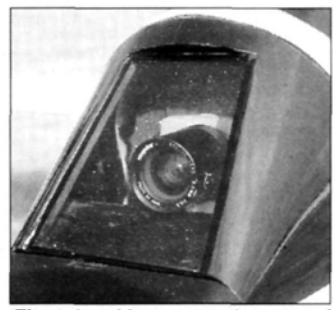
Home-Built Reconnaissance?

Anyone who needs proof that aeromodelers are a creative group need only take a look at the project that Carl Beery of Abilene, TX, has recently completed. In addition to being an R/C flier, Carl is also a radio ham and an amateur video enthusiast. About three years ago, Carl decided to combine these interests in a single package. The result is this home-built RPV (remotely piloted vehicle) that he successfully demonstrated at the Southwest Fan Fly. The airborne vehicle has a 10-foot span and a scratch-built RFB fantrainer powered by a Zenoah* G-62 and equipped with an onboard starting system. The fan consists of five Zinger* 12x12 prop blades attached to a machined metal hub. This propulsion package produces 22 pounds of static thrust at 9,100rpm, which provides more than adequate power for the 31-pound model. The "eye" of the system is a Sony color camera coupled to a downlink transmitter that sends video data to the ground-base receiver. Although the camera's position is fixed, shooting forward only, its lens provides a 60-degree field of view, which is enough to provide excellent visual cues for orientation.

"Cockpit" portion of the Berry RPV system. Color TV monitor in upper center of photo displays view from the camera (located in canopy area of the fantrainer) as well as air speed and altitude read outs.

For the "cockpit" or ground-based portion, Carl started with a Futaba* 7UHF system, a narrow-band FM video receiver, a 19-inch color monitor and a surplus SEGA Turbo video-game enclosure. Blending all these components together, stirring gently and brewing over a period of two years, Carl now has what has to be one of the neatest accomplishments to come down the R/C pike in quite some time. Carl sits in the "cockpit" and is hooked up via intercom and the equivalent of a trainer cord to a backup pilot who is positioned outside and maintains direct visual contact with the fantrainer, and who can assume immediate control should any difficulties be encountered. During the demo flight, I watched the airplane and TV monitor alternately and was fascinated by what I saw. It was like a real-time, real-world video game! Carl promised me the opportunity to fly it the next day but, unfortunately, the winds picked up considerably and prevented further demo flights.

Carl Berry and his giant fantrainer RPV system. It uses off-the-shelf components, including a Futaba radio.



The color video camera is mounted behind the windshield of the fantrainer and provides a true "pilot's- eye view of the terrain to the ground-based operator.

Having accomplished this extraordinary R/C feat is a real tribute to Carl's resourcefulness and ingenuity, but it becomes even more significant when you consider that the entire project cost around $3,500! For those interested in duplicating Carl's efforts or just reading about how it was done, a two-volume set of "How-To" books is being prepared by Supercircuits*.

You'd think that just having this system available to play with would be enough to satisfy Carl—not so! His next objective, which is already well under way, is to shrink all the video components presently located in the "cockpit" and install them all within a helmet that the operator will wear! Think about it, and imagine the possibilities: air-to-air combat, formation flying, pylon racing! We often refer to R/C flying as a true three-dimensional activity. Are we now looking at the fourth dimension?

orientation programs and certification/qualification courses for individuals who might be interested in operating one of the turbines in the future. They are not difficult to operate but, because their use is so foreign to most modelers, some stringent procedures and usage disciplines, which can only be learned through formal training, must be developed and maintained. Let there be no doubt about it: real turbines will be very much a part of future R/C jet activities.

SIZES AND SPEEDSTERS

As reported three years ago, the emerging favorite in the scale-jet world is the large model. Two of the newest and largest single-engine kits now available are, strangely enough, the same airplane: the T-33 T-Bird. This great airplane is offered in "big" and "bigger" sizes by Bob Violett Models* and Jet Model Products* in 80-inch and 88-inch-wingspan models respectively. Both are highly prefabricated and use a lot of high-quality fiberglass. The JMP kit (brainchild of Tom Cook), however, has nearly all of its components molded, including the wings, flaps and empennage. I'll bet you could have one ready for paint in two weeks! Other "big uns" on hand were the F-89 Scorpions and A-7 Corsair IIs from E.T.A. Models*, the exquisite Republic F-84G Thunderjet built by Mike Kulczyk, the T-38 Talon by Tom Sewell and the 1/4-scale BD-10 from ole Colonel Bob. Three scratch-built beauties! Carrying things a step further in the "big" arena were the twins, represented by models

Lynn McCauley's North American XB-70 Valkyrie just after rotation. Lee Rice piloted this unique, scratch-built design that was powered by a single Dynamax fan.

such as Carl Spurlock's Byron* F-15, Lowell Wexler's SR-71 Blackbird, John Carlson's enormous MiG-29, Todd Nicholson's semi-enormous MiG-29 Fulcrum (distributed by DCU*) and a number of examples of the twin that started it all—the JMP F-4 Phantom.

Those feeling the need for speed could satisfy their urges by flying through the traps at what seemed to be, in many cases, 1 knot short of extinction! Chris Huhn skillfully flew his BVM Aggressor and ended up the winner with 220mph posted! His flying and trajectory through the traps were beautiful, and the plane appeared to be on a wire—in sharp contrast to some other speed merchants! I said it there, and I'll say it here: some of these speed trials are starting to get very scary! Just because a product is designed, tested and holds together with a qualified flier operating the sticks doesn't mean everyone who can pay the Visa bill to own one should be building or flying one! It's kind of like the doctor who makes a smoking hole in the landscape with his newly acquired full-scale P-51, proving once again that money and 100 hours of Cessna 150 time do not a Mustang driver make!

The other end of the speed spectrum was explored during the Target Speed Event in which the flier picked the slowest possible speed that he thought would safely fly his plane through the traps. Eldon Bennett won the competition flying the big F-89 Scorpion at 27mph, which was better than his prediction of 29mph! The airplane, big as it was, almost hovered!

STILL BIGGER?

Throughout the weekend, model flying was occasionally interrupted by the arrival or departure of full-scale F-16s based at Bergstrom and flown by pilots of the 924th TFG, Air Force Reserve. Between hops, these pilots visited the model event and marveled at the capabilities that the R/C jets displayed. They were recruited to judge all the F-16s on hand, and they awarded the "Best F-16" trophy to Tom Robertson for his outstanding example built from a BVM kit. Their price of admission to the event was the loan of one of their full-scale Falcons that was put on static display for everyone to look at, photograph and enjoy. More than one potential scale modeler with an F-16 kit in his workshop was seen with camera, tape measure and paper in hand, taking notes of everything he planned to apply to his model!

Eldon Bennett's F-89 Scorpion is silhouetted against the sunset.

OBSERVATIONS AND DIRECTIONS

The number of participants at events like this—many of them first-time jet fliers like Mike Goolsbee with his A-4—provides a great opportunity to sample a cross-section of modelers and get their views on where jet modeling is heading. Two impressions were unanimous: it's growing worldwide, and it's not as difficult to get into as many of the first-timers originally thought. (And to think we've been preaching that for years!) Those who have been involved with ducted-fan models for a while concluded that the trend toward larger, scale-type models flying at lower, scale-like speeds, will continue, thereby drawing more sport modelers, who now fly props, into the ranks of fan fliers. They also said that the speed events would probably continue because a lot of fliers still enjoy them, but participation will become self-limiting to a small group who feel confident enough in their own abilities and equipment to fly at 200+mph.

Finally, there is no doubt in my mind that real turbines will become an integral part of the jet-modeling scene in the future. Just as fans themselves have evolved and improved over the past decade and engines have been engineered to stay together and perform at 21,000+rpm, and speeds have increased from a mild 90mph to over 200, turbines are a reality now. If there's a challenge, you can count on modelers to take up the call!

For some reason—maybe the diversity of subjects, maybe the number of new faces—this year's SWFF was my most enjoyable yet. Overlooking the one day of brutally hot weather, I came away with the feeling that the ducted-fan segment of the R/C world was providing a great avenue for a lot of new modelers to explore. Plans for the '94 edition of the event are well under way, and it appears that it will be held at B.B. Weber's Bomber Field in Monaville, TX (near Houston), in September. You should make plans to attend and participate.

The Northrop F-89 Scorpion—a rarely seen jet—is now available as a full kit from E.T.A. Models. Byro-jet driven, it was airborne throughout the weekend. Eldon Bennett demonstrated its remarkable slow-flight ability.

I opened this coverage suggesting that if you could only make it to two ducted-fan events, the Greater Southwest Fan Fly should be one of them. The other might just be the Superman Fan Fly in Metropolis, IL. Watch for coverage in an upcoming issue of *Model Airplane News*.

**Here are the addresses of the companies mentioned in this article:*

O.S./Great Planes Model Distributors, *P.O. Box 9021, Champaign, IL 61826; (217) 398-6300.*
Viojett; *distributed by Bob Violett Models.*
JPX Turbines; *distributed by Bob Violett Models.*
Bob Violett Models (BVM), *170 State Rd. 419, Winter Springs, FL 32708.*
Jet Model Products, *211 N. Mullen Rd., Belton, MO 64012; (816) 331-0356.*
E.T.A. Models, *4930 47th St., Lubbock, TX 79414.*
Byron Originals, *P.O. Box 279, Ida Grove, IA 51445.*
DCU, *1564 S. Anaheim, Unit B, Anaheim, CA 92805.*
Aeroloft Designs, *2940 W. Gregg Dr., Chandler, AZ 85224.*
Zenoah; *distributed by ISC Intl., P.O. Box 40116, Indianapolis, IN 46240.*
Zinger; *distributed J&Z Products, 25029 S. Vermont Ave., Harbor City, CA 90710.*
Futaba Corp. of America, *4 Studebaker, Irvine, CA 92718.*
Supercircuits, *13015 Debarr Ave., Austin, TX 78729; (512) 335-9777.*
Dynamax; *distributed by Jet Model Products.*
Royal Products Corp., *790 West Tennessee Ave., Denver, CO 80223.*
Nick Ziroli Models, *29 Edgar Dr., Smithtown, NY 11787.* ■

The Jet Model Products T-33 by Tom Cook is perhaps the most highly prefabricated jet kit available today. It's mostly fiberglass (including the outer wing panels); its wingspan is 88 inches; and it weighs 19 pounds.

Among the flying jets that the ever-present Harry Woods brought was this Royal Cessna Citation .20-size twin.*

Editor's note: because the technically sophisticated Piezo Gyro was only recently introduced, the people who know it best are the JR reps who initially tested the unit. In the interest of getting the word out to our readers on this product sooner rather than later, we asked Mike Fortune, a JR rep, for a technical description of the Piezo and tips on its use. (It's Model Airplane News' policy to state when a rep is writing on a product.) Mike has more flight time and experience with this gyro than most.

JR's NEJ-1000 Piezo Electric Gyro

by MIKE FORTUNE

SEVERAL YEARS ago, when I returned to flying helicopters again, I purchased the most modern equipment available, including a new device called a gyro. From that time until now, we've seen great advances in the helicopter, radio and engine fields. Although the gyro has improved somewhat, it had not improved at the same rate as, for example, a carbon graphite X-Cell Pro or a JR PCM 10S. However, JR has just introduced what I believe is going to be the next family of gyros. Distributed by Horizon Hobby Distributors*, JR's new, patented NEJ-1000 Piezo Electric Gyro, or simply the "Piezo," as it's being called by many modelers, is unlike any other gyro. Incorporating advanced piezoelectric crystal-sensing elements, the Piezo is a non-mechanical unit, i.e., it has no moving parts—motors, flywheels, bearings, gimbals, etc.—to wear out, to create RF noise, or to go "out of whack." What results is a gyro 10 times more sensitive to motion, in a package smaller and lighter than other gyros. Intrigued?

The JR NEJ-1000 Gyro. Left—gyro sensor; center—amplifier; right—remote gain controller.

HOW IT WORKS

Most basically, the Piezo operates using a triangular sensing device to detect motion. For the sake of explanation, we'll simplify things a little. Imagine a hollow prism (a triangular tube) standing on its end. Three small piezo crystals are secured to the inner sides of this prism: a small "feedback" crystal is bonded to one of the three sides; two "sensing" crystals are bonded to the remaining two sides. The feedback crystal sends voltage oscillations, like magnetic fields, to the two sensing crystals. These oscillations hit the sensing crystals and then "bounce" back to the feedback crystal. A repetitive loop is established with oscillations going from the feedback crystal to the sensing crystals, etc.

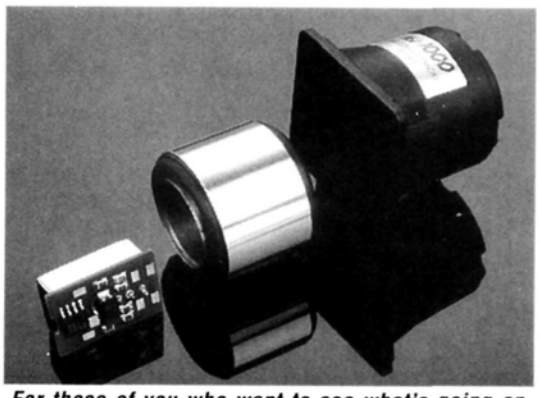
How does this contribute to tail-rotor stability? Imagine this prism on its end on a platform near the center shaft in your helicopter. As a gust rotates the model about its center shaft, the prism also begins to rotate. This rotating motion causes the two piezo sensing crystals to become distorted—physically changing shape.

Because of this distortion, the voltage oscillations being sent to the sensing crystals won't bounce back to the feedback crystal in the way they did when no motion was encountered. The feedback crystal "reads" these new oscillations and tells the receiver to begin moving the tail-rotor servo in a direction that counteracts the original motion imparted by the gust. The remarkable thing is that motion is sensed without the use of the electro-mechanical parts found on standard gyros. The flywheel and motor of a standard gyro, for example, are subject to inertial and other forces. The Piezo's non-mechanical crystals are virtually unaffected by these forces.

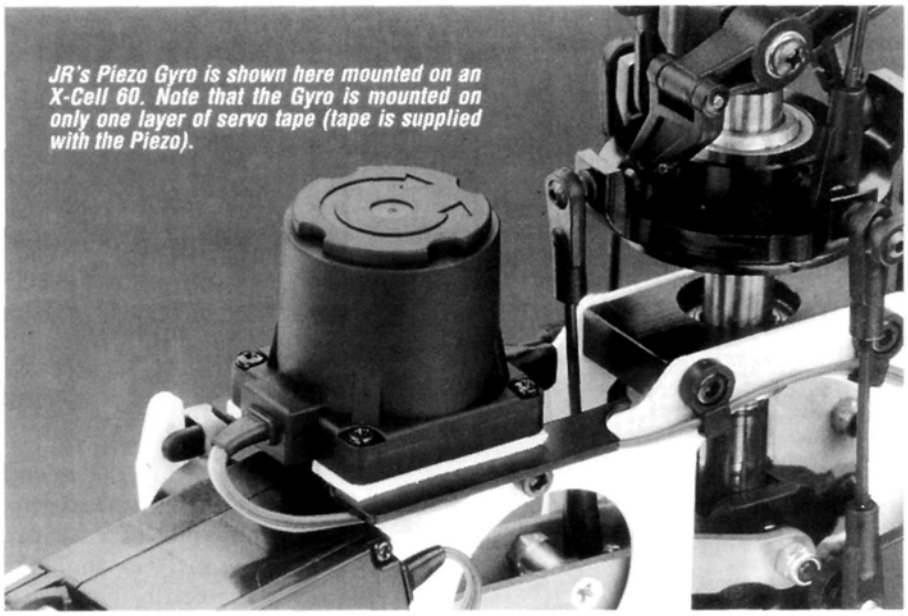
COMPARISONS

When I received the Piezo, I did some comparisons with the JR 120 gyros that I've been flying. My 120s weighed 115.1 grams, and my Piezo weighed 84.8 grams—a 25-percent weight savings! Also, current drain at idle (no load) and under load was less for the Piezo than for the 120.

One test was interesting: when I moved the Piezo a small amount, the current meter would show a small increase in current flow and, then, for a large movement, a large current draw. However, for the 120, a small movement would show a



For those of you who want to see what's going on inside: left—Piezo element; center—vibration isolator/magnetic shield; right—outer housing.



JR's Piezo Gyro is shown here mounted on an X-Cell 60. Note that the Gyro is mounted on only one layer of servo tape (tape is supplied with the Piezo).

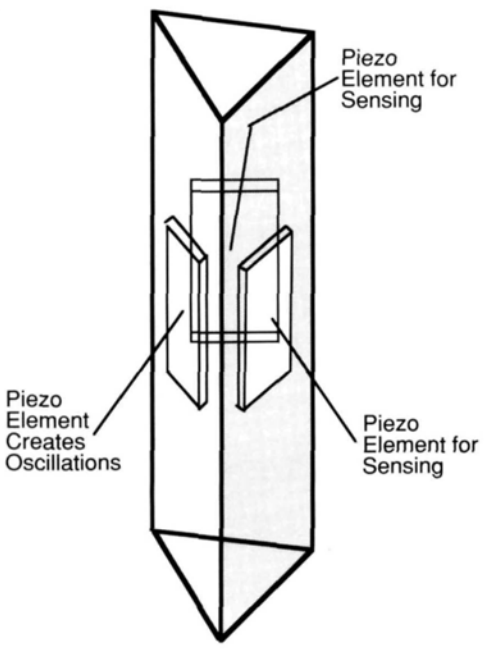
PHOTOS BY MIKE FORTUNE

large increase in current draw and for a large movement, the current would be not much more than for a small movement.

What does this mean? It appears that the Piezo reacts proportionally to whatever the upset (yaw) is. A small upset equals a small correction, and a large upset equals a large correction.

SET UP

Because the Piezo is unlike any other gyro that I've flown, it also requires a different type of setup. If you have a computer radio, set your tail-rotor end-point adjustments to the maximum (150 percent for JR owners). Next, I recommend that you install a servo arm on your tail-rotor servo that will allow you to reach the mechanical limits of your tail rotor, both left and right. Why? Other mechanical gyros have about a 250 to 300 degrees-per-second sensitivity limit. In other words, up to about a 250- to 300-degree yaw or spin, the mechanical gyro can counter this upset; however, at anything beyond this, the mechanical gyro has already reached its limit. The Piezo doesn't reach its limit until approximately 720 degrees/second of rotation!



If you want to do any type of aerobatics that involve turning the tail (like the 540-degree stall turn, or loops with pirouettes at the top), you'll have to overcome the Piezo's awesome grip. In order to do this, you may have to run a longer servo arm than the one you use now. A good place to start would be as follows:

If tail-rotor hunting occurs at less than approximately 65 percent, your servo arm is too long. However, if tail-rotor hunting doesn't occur at 100 percent, you'll need a longer servo arm. Depending on the performance you want in your aerobatics (pirouettes that look like a blur), you may have to compromise some of your hover stability. However, it's important to remember this: tail-rotor speed, diameter, design and even make (plastic, wood, or carbon fiber) will influence your final gain settings. When using a long servo arm, don't be alarmed that the tail-rotor linkage will bind on the ground when you deflect the stick full left or right. The gyro will be removing about 70 percent of servo travel while in flight, so your linkage will never bind in flight.

Next, mount the gyro on the included doubled-sided servo tape that is ⅛ inch thick, as per the instructions. Mount the gyro amplifier in foam as you would a receiver, and the remote gain controller can be mounted anywhere convenient using Velcro®-brand fastener or double-sided servo tape.

3-SECOND INITIALIZATION

When you turn on your radio, you now have an extra step to follow. When you first turn on your receiver, don't move the helicopter for approximately 3 seconds. During this 3 seconds, the Piezo's centering circuit is aligning itself. Once the gyro is left motionless for 3 seconds and the red LED is illuminated, the alignment is complete. If you move the helicopter during this 3 seconds, simply turn the switch off and then back on again; wait until the gyro is aligned, and you're ready to fly again.

ADJUSTING GAIN

One of my favorite features is the remote gain controller. When I need to adjust a standard gyro, I have to land the machine, stop the rotor head, access the gyro (remove the canopy, etc.), make the adjustment with pots on the gyro, and then fly to see if my adjustments were enough. With the Piezo, I simply land the helicopter, access code 44 on my JR PCM-10 radio (also on the PCM-10S), make the adjustment with the transmitter and then fly away.

Those of you who aren't flying the PCM 10 can use the travel adjustment feature of your radio to control the gyro's gain. Simply flipping the switch and adjusting the travel amount will change the gyro's gain for that auxiliary switch position. Keep in mind that zero on your travel adjustment may not give zero gyro gain, or maximum travel adjustment may not be enough to obtain maximum gyro authority.

FLYING

• **Hover.** On a conventional gyro, you would set your gain controller to the maximum and reduce its gain until the tail stops wagging. Well, the same rules apply to the Piezo, but you're only halfway there. Once you've reduced the gain until the tail has stopped wagging, fly the helicopter in circles, or hover the machine in a crosswind.

At this point, you'll probably notice the tail wagging slightly. Continue to reduce the gain as necessary. You'll find

(Continued on page 78)

SUKHOI

(Continued from page 57)

piece of plywood cut to fit over the servo-mounting cavity in the wing. I mounted the servo on the plywood so that only the servo arm pokes through the plywood to the outside of the plane. The entire assembly is now mounted on the wing with four wood screws at each corner. Small gussets of plywood are glued to the inside of the servo cavity for the four screws to anchor to. This makes for a very clean servo installation that also allows easy access to the servo for maintenance.

Final all-up weight of the Sukhoi is 9.7 pounds (without any ballast required to achieve the proper CG position).

The finished Sukhoi is an impressive-looking bird. Everything fit the way it was supposed to; I certainly enjoyed constructing this one.

**Here are the addresses of the companies mentioned in this article:*
Byron Originals, *P.O. Box 279, Ida Grove, IA 51445.*
O.S./Great Planes Model Distributors, *P.O. Box 9021, Champaign, IL 61826.*
Top Flite, *distributed by Great Planes Model Distributors (address above).*
MonoKote, *distributed by Great Planes Model Distributors (address above).*
Scale Model Research, *3114 Yukon Ave., Costa Mesa, CA 92626.*
McDaniel R/C Inc., *1654 Crofton Blvd., Ste. 4, Crofton, MD 21114.*
Ace R/C Inc., *116 W. 19th St., Box 511C, Higginsville, MO 64037.*
RCD, *10729 Wheatlands Ave., Ste. C, Santee, CA 92071.*
Futaba Corp. of America, *4 Studebaker, Irvine, CA 92718.*
APC Props/Landing Products, *P.O. Box 938, Knights Landing, CA 95645.* ■

PIEZO GYRO

(Continued from page 76)

hovering to be an absolute blast! It's as if someone else is helping you fly the tail. It made my X-Cell 30 feel as if its tail was flying on autopilot.

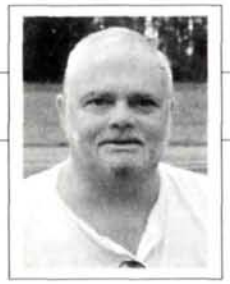
• **Forward flight.** When setting gain for forward flight with the Piezo, a good place to start is 20 percent (relative to total range) less than your hovering setting. If my hovering gain is set to 65 percent (using a PCM-10, or a PCM-10S radio), I would start at about 45 percent for forward flight gain. This is just a starting point, as the forward flight gain will vary with different makes of helicopter.

I recommend that you try your first stall turns and 540-degree stall turns higher than you normally would. You'll find that these maneuvers will feel easier to control. I noticed when doing 540s that the helicopter didn't wind up (spin faster) on the last 360 degrees as do my mechanical gyros. If you don't have enough tail-rotor throw, you could use up a lot of altitude doing your first 540s. Be safe; start high.

Before the Piezo was marketed here in the U.S., Horizon Hobby Distributors asked me if I'd like to fly one of the prototypes. Of course, I jumped at the opportunity to fly what has to be the most advanced gyro available.

(Continued on page 121)

SPORTY SCALE TECHNIQUES



FRANK TIANO

RALLY OF EAGLES

AS PROMISED, this month's "Sporty Scale" will take a look at one of America's fastest-growing scale events—one that unites pure enjoyment and considerable excitement in a noncompetitive atmosphere. Welcome to the Rally of Eagles, an all-scale fly-in where the motto is, simply, "No dogs allowed"! This year's meeting place was the northern Florida town of Navarre, minutes off the Gulf of Mexico and about a half hour east of that "you gotta see it" Naval Air Museum in Pensacola. Our old friend Jack Dorman and his friendly group of local modelers were responsible for obtaining the best possible flying site in the area—a somewhat deserted military practice airfield featuring unlimited runway and fly-over space.

For those of you who haven't read about the Rally before, it's truly a fantastic weekend for scale modeling. This year, there were 40 pilots, 23 crewmen and 63 airplanes assembled in an area where noise wasn't a problem and fun was the ultimate goal. The Rally encourages competition scale modelers and fun-fly scale modelers alike to join together for three days of relaxed flying after the contest season has come to end. What's really nice to see is how the hobby industry really gets behind the Rally, and it should, because it is becoming somewhat of a showcase for new and interesting products to be displayed or wrung out before introduction into the market place. This year, the Rally received support from Sig* Mfg., Bob Violett Models*, the Zap* gang, Merriwether Circuit Design and Futaba*.

It's finally finished. Frankie T's new P-47, complete with scale actuating Fowler flaps, made its debut at the Rally. The prototype, as you would expect, is a bit heavy at 28 pounds. It uses an Enya 240 V-twin and swings a Zinger* 18x8 prop. It's a possible prototype of a new Platt kit for 1995!*

Here are just a few of the prop jobs; they're mostly warbirds. The average wingspan is 82 inches, average weight, 22 pounds, and the average engine has 2c.i. of displacement.

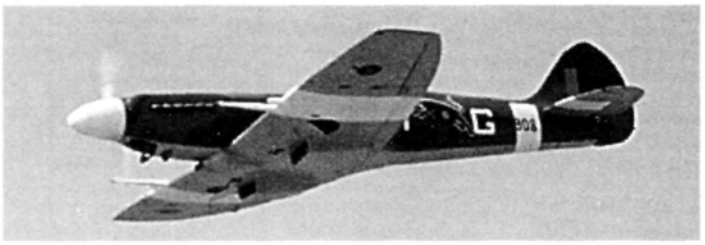
PILOT PLANNING

Because the event draws pilots from considerable distances, it commences on Friday morning and pretty much ends on Saturday evening so that those who have traveled can get back to reality and their primary source of income by Monday morning. For the several guys who live within two or three hours, the flying site remains open throughout Sunday as well. We had a 12-hour drive facing us, so we decided to leave early Sunday morning after stopping by to say good-bye to the 30 or so guys already at the field at 7:30 a.m.! However, our Friday and Saturday provided us with plenty of excitement; we understand that someone stopped counting after 230 flights had been flown! Especially interesting is the WW II "gaggle" that Mel Whitley orchestrates; it places eight warbirds in the air at the same time, in a right-hand, safe, racetrack pattern, much to the delight of every one of the spectators and other pilots as well.

Three of the prettiest BVM F-16s you're ever going to see in one place at the same time. Front to rear: Tom Robertson (Pilots' Choice), Bob Violett and Jerry Caudle.

HANGAR TALK

Like most two- or three-day events, whether they are big or small, scale or pattern, Saturday night will usually feature a barbecue, banquet, pig roast, picnic, dinner, or some other form of informal shebang intended to further cement the



Dan Luke did an outstanding job on this Yellow Aircraft Spitfire. Powered by a 2.0 Sachs engine, this clipped-wing version features a 1946 Far East paint scheme .*

Flown by Paul Byrum from Simpsonville, SC, this unusual, rarely modeled, Fiat G-55 Centaur has an 80-inch wingspan and weighs 18 pounds.

relations of those unfamiliar with one another. The Rally was no exception. In fact, where many events have to settle for a local hall of some sort to hold their function, this one was unique in that we had an entire half of a popular restaurant to ourselves and had one of the finest meals you could have possibly hoped for, anywhere! Our master of ceremonies, Mr. Mel Whitley, presented several awards for outstanding aircraft in a particular category. These included a Best Civilian

Joe Demicok brings his big Spitfire in for a landing. Built from a Yellow Aircraft kit, it uses a SuperTigre 3000, and it only weighs 23 pounds.

Bob Fiorenze's 110-inch P-38 is built from a Yellow Aircraft kit and uses two G-38s for power. A gyro on the rudder helps in an engine-out situation. It received the Best Military Award.

As far as we know, Bob Fiorenze has the only twin-engine model of the F-117 Stealth fighter flying today. Here the "weird one" is caught moments after lift off.

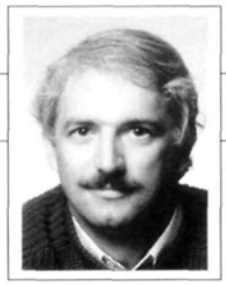
award to Joe Moore of Clearwater, FL, for his immaculate Turner Special, the Best Military to Bob Fiorenze of Winter Springs, FL, for his awesome, new P-38; the Best Jet award to the equally awesome T-33 of Jerry "Blacktop" Caudle, who drove all the way from Metropolis, IL; and the Pilots' Choice award to the incredible BVM F-16 of Tom Robertson, who came in from Bossier, LA, in the unbelievably huge Mike Haddox motor home. Of course, the meal was followed by a playful, humorous roast of all the pilots by yours truly, but unfortunately, it was cut considerably short. Otherwise, we had a great time and, from what I hear, the restaurant really appreciated having a room full of big spenders so deep into their off-season!

PERFECT WEEKEND

A beautiful flying site wasn't the only bonus received that weekend. How about the fact that there was not even one single radio interference conflict, not one dangerous flight, not one airplane lost and only one broken prop in over 200 flights!? When you combine the fabulous site, the generous sponsors, outstanding airplanes, perfect weather and a great group of modelers, you are all but guaranteed success. The Rally of Eagles was exactly that—a huge success. Congratulations to all who had anything to do with it.

**Here are the addresses of the companies mentioned in this article:*
***Sig Mfg. Co.,** 401 S. Front St., Montezuma, IA 50171.*
***Bob Violett Models (BVM),** 170 State Rd. 419, Winter Springs, FL 32708.*
***Zap;** distributed by Pacer Technology, 9420 Santa Anita Ave., Rancho Cucamonga, CA 91730.*
***Futaba Corp. of America,** 4 Studebaker, Irvine, CA 92718; (714) 455-9888.*
***Yellow Aircraft,** 203 Massachusetts, Ave., Lexington, MA 02173.*
***Enya Model Engines/Altech,** P.O. Box 391, Edison, NJ 08818-0391.*
***Zinger;** distributed J&Z Products, 25029 S. Vermont Ave., Harbor City, CA 90710.* ■

AEROBATICS MADE EASY



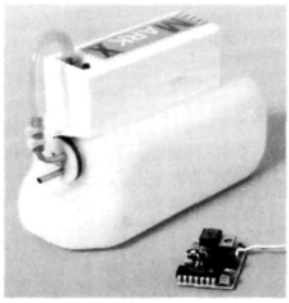
DAVE PATRICK

SMOKE 'EM!!

SMOKE IN AN aerobatics column? Sure, why not? Ever go to an air show? Even at the Tournament of Champions (TOC), just about everyone used smoke in their 3-minute free program, including yours truly. Some might even call it the "icing on the cake," or just plain attention-grabbing. For me, it adds a whole new dimension to the art of flying by highlighting your maneuvers. But most importantly, it's just plane fun!

Having said all that, I'd like to take this opportunity to explain what makes smoke and to go over a few different ways to add smoke to your aircraft. I'll discuss different methods for different types of engines and, of course, sneak in a few hints that I have picked up on the way to get even better smoke!

First this month, let's look at two ways to add smoke to a Y.S.* 1.20: one uses the Y.S.'s own pressure system, the other uses a new pump called "Simple Smoke." Next month, I'll discuss some simple, but reliable, smoke systems for 2-stroke engines in common use, and techniques applicable to big gas engines.



This is the system that I used at the 1992 TOC. It's simple and very effective. I used it with an Infinity 4.2 engine and a Slimline TOC muffler.

THE BASICS

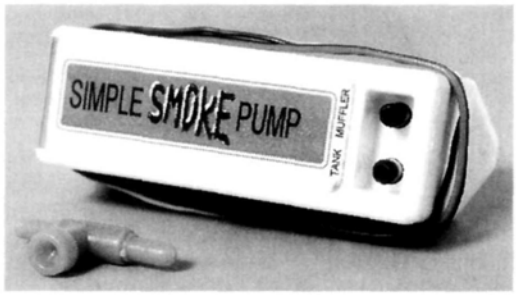
What we are really trying to achieve is to vaporize oil by pumping it into a chamber (usually a muffler). The more oil you can vaporize properly, the better the smoke. Although the oil isn't really burning, it is, in a sense, smoldering in the high-heat, low-oxygen environment of the muffler or smoke chamber. It's also important to find the correct flow rate for your particular setup and to pre-heat the oil just before it enters the smoke chamber. If too much oil is pumped in, it passes through the muffler un-vaporized and does nothing but cool the exhaust system, further reducing the effect. Getting started requires some measurement and experimentation.

CAN THE Y.S. HANDLE THE PRESSURE?

As it turns out, it sure can! It all started a couple of years ago. I was experimenting to get smoke out of 1.20 4-strokes and fell upon the idea of using the Y.S. engine's own fuel delivery system to pump the smoke oil into the muffler. This system works well without any loss of engine power and very little gain in weight. It may look complicated, but it really isn't. Follow Figure 1 as I walk you through how the system works.

The Y.S. engine has two hose fittings on the front; one is for the fuel line, and one is for the tank pressure line. The first step is to install a T-fitting to tap pressure from the pressure side of the engine, i.e., from the tank pressure line. This fitting should be installed *after* the check valve, i.e., downstream from it, on that pressure line. Now, a second check valve is installed just after the T-fitting to isolate the smoke system from the engine fuel system. From here, the line is routed into what I call a "hopper" tank. (Note that this line is hooked up to the clunk.)

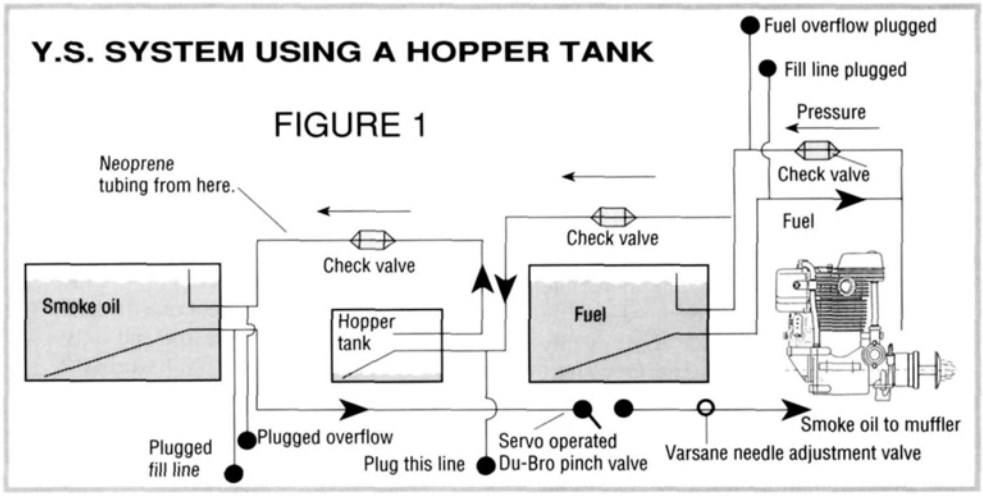
On this line is still another T-fitting with a line that has been plugged. The purpose of this line is to release pressure from this tank and to purge any fuel that has worked its way into the hopper tank from the engine. The theory behind the hopper tank is to have a staging area for the pressure, so that regardless of the fuel or smoke-oil tank level, or the throttle setting, there will always be sufficient pressure to operate both engine and smoke system. An added benefit is that the hopper tank prevents fuel from contaminating the smoke oil. I haven't tried this system without a hopper tank (it may work).



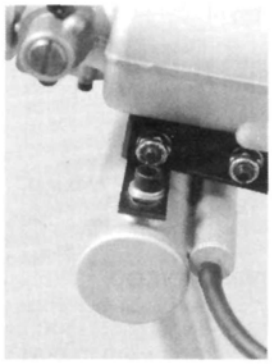
This is the Simple Smoke System with its adjustment valve. It's an integrated system that makes installation a snap. It will work with a wide variety of engines.

We install another check valve on the hopper tank's overflow line (note that one end of this line is directed straight into the hopper tank) to prevent smoke oil from backwashing into the hopper tank. (At the very least, smoke oil could damage the silicone fuel lines.) This is important: from this check valve on, *all* the lines in the smoke system must be neoprene.

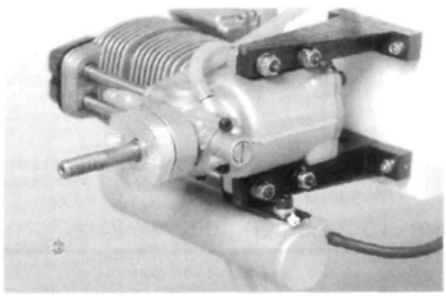
This pressure line doubles as the over-



flow line from the smoke tank. Connected to this line, there is a T-fitting with an overflow line that must be plugged during operation. The smoke-oil tank "clunk" line delivers the smoke oil under pressure to the muffler. To start or stop the flow of smoke oil, we use a Du-Bro* or similar pinch valve to turn the system on or off. It's very helpful to your servo to have the pushrod "in-line" in the closed position (see Figure 3). As an option, you can add a Varsane Products* remote needle adjustment valve to control the smoke-oil flow when the system is turned on. This would be added between the servo-operated pinch valve and the muffler (see Figure 1).



This close-up of the Slimline muffler shows neoprene tubing—a must when you're using smoke oil.



Here's a Y.S. 1.20 mounted on a CGM Sukhoi using the Slimline smoke muffler. They make a variety of muffler styles that will fit most aircraft. Note that the smoke version has a preheat chamber attached at the rear of the muffler.*

HARDWARE RECOMMENDATIONS

As for the hardware that I use and can recommend:

- *Du-Bro smoke valves.* (CB* valves also work very well.)
- *Y.S. check valves.* (They have a very low mass, which helps them follow the rapid firing impulses.) I've tried a few other brands, but without success so far.
- *Slimline* mufflers.* To be honest, I haven't tried others, but I can highly recommend Slimline mufflers for the Y.S. 1.20, with or without preheat. Preheat does give better smoke, but their regular muffler worked very well.
- *Super Dry smoke oil, from MDW Aviation Associates**. So far, this seems to be one of the best. Again, I haven't used all the brands that are out there, but I've tried a few.

SIMPLE SMOKE SYSTEM

For the last TOC, I wanted to add smoke to my big Godfrey Extra 300 that's powered by the Infinity 4.2 engine running on glow. So, I threw together a system utilizing a Sonic Tronics* 6V fuel pump and a servo operating a switch, which was assembled to the smoke oil tank. (I also used a Jomar* electronic switch to eliminate the servo in a back-up unit and an old 225mAh 5-cell pack to make it go.)

Well, it worked very well, and when Mr. Albert Tejera of Tejera Microsystems* saw this system in the "Wring It Out" video, Volume 3, he decided to improve the system and—fortunately for a lot of modelers—has recently made it available. Although it's somewhat heavier than the Y.S. system described above, it's very easy to install. I suspect that it will work on any engine from a .40 2-stroke on up. The instructions are very comprehensive, so I won't go into much detail, except to illustrate the system via a drawing.

THE 12 SMOKING COMMANDMENTS

Now that we know the "Big Why" and how to approach a 4-stroke engine, let's look at a list of important points that are essential to getting good smoke.

1. The more heat, the better. Big gas engines deliver the most heat, next is 4-strokes on glow, and last, 2-strokes on glow. All can be made to work fairly well!
2. Get a good flow of smoke oil to the engine (but not too much).
3. Inject smoke oil in the right place—near the hottest part of the muffler and at a place where the velocity is highest.
4. The slower the airplane, the denser the smoke. An engine that's equipped with a larger-diameter, lower-pitch prop is generally a good direction to go in.
5. Use a neoprene line at all places that come in contact with smoke oil.
6. If possible, use a muffler or chamber that has baffles; they give the smoke oil a longer "hang" time.
7. Preheat if at all possible. Sometimes, it can make the difference between success or failure (more on this in the next issue).
8. When in use, turn smoke off when the throttle is lower than about 75 percent. If you don't, the engine may flame out!

The Smoke-riter is an alternative method for adding smoke. It works, but only once, and it has limited density. You also have no control over the smoke once it starts, and it lasts for only a short while.*

Setting up your radio to mix throttle with the smoke channel can be really helpful here!

9. Try to set up your muffler smoke chamber so that the smoke fluid doesn't accumulate. The smoke chamber or muffler exit should point down.
10. Smoke can attack some covering films and paints. Test it, or call the manufacturer.
11. Know when to smoke and when not to. Leaving it on all the time during flight reduces the impact. Turning the system on and off shows command and control while highlighting specific maneuvers.
12. Because the system is under constant pressure, safety wire all fittings.

SIMPLE SMOKE ON A Y.S. 120
FIGURE 2

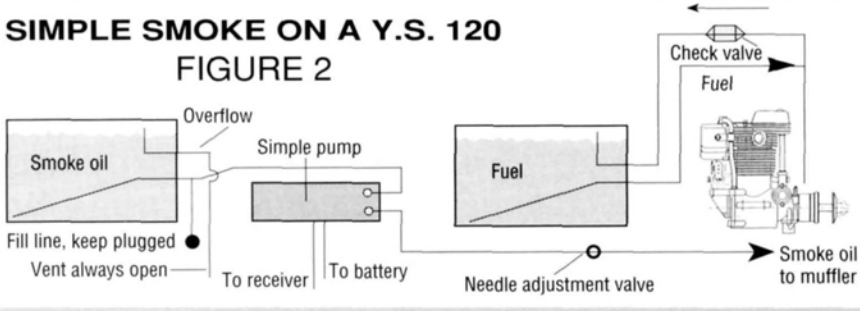
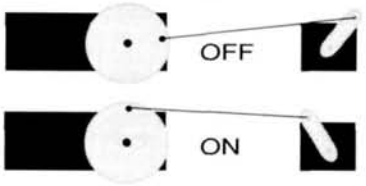


FIGURE 3



This pushrod arrangement gives maximum push to pinch the line with the minimal amount of servo load.

WHAT SMOKE FLUID?

I've used a variety of commercial smoke fluids but haven't experimented much with mixing my own. Two brands I can recommend are Bennett's Best Smoke Fluid from B&B Specialties* and Super Dry Aviation Smoke Oil. I used Bennett's best at the last TOC and plan to use Super Dry at the next.

IN CLOSING

In closing, I'd like to take this opportunity to mention that a lot of this data was accumulated during the making of a new instructional video called "Smoke 'Em" by Gulf Stream*. I want to thank all who have given me loads of excellent information. This video shows a lot of different systems in operation so that you can make a well-informed choice on which is most suited to your application. Next month, we're going to show how to put smoke on your sport 2-stroke aircraft and on those big gas engines.

Until next month...smoke on!

**Here are the addresses of the companies mentioned in this article:*

***Y.S.,** distributed by Futaba Corp. of America, 4 Studebaker, Irvine, CA 92718.*

***Du-Bro Products,** 480 Bonner Rd., Wauconda, IL 60084.*

***Varsane Products,** 546 S. Pacific St., Ste. C-101, San Marcos, CA 92069.*

***CB Associates Products;** distributed by CB/Tatone Inc., 21658 Cloud Way, Hayward, CA 94545.*

***Slimline Mfg.,** P.O. Box 3295, Scottsdale, AZ 85257.*

***MDW Aviation Associates,** 9707 S. 70th Ave., Bridgeview, IL 60455.*

***Sonic Tronics Inc.,** 7865 Mill Rd., Elkins Park, PA 19117.*

***Jomar,** 3440 Riverhills Dr., Cincinnati, OH 45244; (513) 271-3903.*

***Tejera Microsystems,** P.O. Box 340608, Tampa, FL 33694.*

***B&B Specialties,** 14234 Cleveland Rd., Granger, IN 46530.*

***Gulf Stream,** P.O. Box 482, Hagan, GA 30429; (800) 531-1784.*

***Carl Goldberg Models,** 4734 W. Chicago Ave., Chicago, IL 60651.*

***Smoke-riter,** distributed by Tower Hobbies, P.O. Box 9078, Champaign, IL 61826.* ■

MODEL AIRPLANE NEWS MAGAZINE
FIELD & BENCH REVIEW

U.S. AIRCORE DESCRIBES their new KnightHawk as an all-weather, sport/utility, multi-mission (AWSUMM) airplane. This is a lot for any one plane to live up to, yet the KnightHawk does it all with ease. This is a plane for pilots with a purpose. If you have always wanted to drop bombs from your plane or take aerial pictures while flying for extended periods, then I suggest that you give the KnightHawk a try. You won't be disappointed.*

The KnightHawk is made of Aircore®, a corrugated-plastic material that's extremely resistant to impact damage. The plane is created by folding die-cut sheets of Aircore® into shape. The KnightHawk is just like a big origami airplane.

by BILL GRIGGS

This aerial background shot of the Las Colinas office park and lagoon near Dallas, TX, was taken from a stock KnightHawk outfitted with a $30 Vivitar PS44S camera. (KnightHawk in foreground was superimposed.)

U.S. AIRCORE KnightHawk

A plane for all seasons

FLIGHT PERFORMANCE

• Takeoff and landing

The KnightHawk has solid control on the ground, even in grass that hasn't been recently cut. My particular plane will take off at ¾ throttle without the aid of flaps. With flaps lowered, the takeoff at full throttle is about 50 feet with a very high-angle climb-out in mild wind. On landing, the plane slows down very nicely with flaps, and very short landings are the norm. When the flaps aren't lowered on landing, the plane lands slightly hotter than most trainers, but well within the norm for sport planes.

• Low-speed performance

At low speeds with the flaps extended, the KnightHawk can be flown at high angles of attack without stalling. When a stall is reached, the airplane simply loses altitude and then starts flying again. To date, I haven't noted any tendency for the plane to drop a wingtip in stall. With this engine, the KnightHawk will slow down quite a bit with the use of flaps.

• High-speed performance

With the Fox .50 engine installed, the KnightHawk moves out quite nicely, but this plane isn't a speedster; it's designed to be a stable platform. In fact, I think it's slightly overpowered.

• Aerobatics

Without the TO-POD installed, the plane will do medium aerobatics. With the Fox .50, vertical climb isn't stellar, but loops and rolls are easy from level flight. The plane will spin, and recovery only requires neutralizing the stick. Inverted flight requires moderate deflection of the elevator to maintain level flight.

• Conclusion

The KnightHawk is a stable, predictable sport plane. It isn't a trainer, but it is a good second or third airplane, owing to the added complexity of ailerons and flaps. The control throws as called out in the plans will provide a slightly docile plane. More experienced pilots will want to increase the elevator and rudder throws for maximum enjoyment.

WOODEN PARTS

I started constructing the KnightHawk by assembling the power cartridge (PC). The PC uses two nose doublers and a hardwood block for the nose gear. After these parts had been assembled with epoxy, I checked to make sure that the servos fit properly. I needed to trim the servo holes slightly for a good fit. Then I painted the PC with a fuelproof paint.

I built the wing spar by aligning the two halves and laminating the dihedral brace on either side of the spar.

While the spar and PC were drying, I assembled the 8-ounce fuel tank. I didn't like the plastic tubing that came with the tank, so I substituted a brass tube for the vent line. The plastic tubing just wouldn't hold a tight enough radius for the vent line to be positioned correctly.

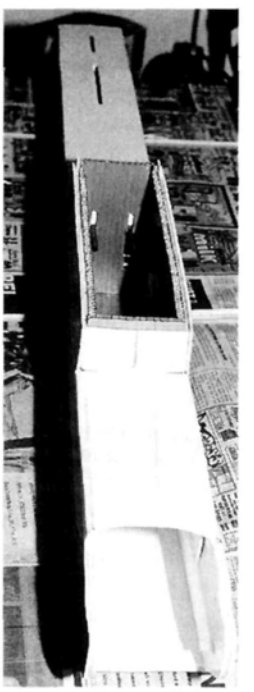
The fuselage construction has begun.

AIRPLANE ON A HALF SHELL

All U.S. Aircore airplanes are made of a plastic material that resembles cardboard. In fact, "Is that cardboard?" is the comment I hear most often. The unique feature of this material is that it bends easily around curves on one axis, yet it's extremely rigid along the opposite axis.

I built the fuselage very quickly. I began by gluing several doublers of various thicknesses to the fuselage using contact cement. The power-cartridge guide rails were then sandwiched between the doublers and the fuselage sides. Next, I spaced the bulkheads along the pushrod outer tubes and fitted the bulkheads into the fuselage slots. I test-folded the fuselage around the bulkheads and then glued them into place. I then added the wing saddle doublers, the turtle deck, the windshield and the wing-mounting dowels.

I ran into trouble installing the wing-mounting dowels, because I didn't follow the directions. I mounted the dowels too low in the fuselage, and as a result, I had clearance problems when I tried to install the power cartridge. I re-drilled the holes in the proper places and filled the old holes with scrap pieces of Aircore® that I cut out with a hole puncher. I then went on to build the stabilizers.



A view of the fuselage after initial assembly.

STABILIZERS

The horizontal stabilizer is made of two pieces of Aircore® that are joined using 12-inch-long dowels. The dowels are inserted between the flutes of each respective stabilizer half. The dowels have to be sanded flat on four sides so that they don't deform the surface of the Aircore®.

The elevators are made by cutting a slit between the flutes on the bottom of the stabilizer and trimming away the excess material until you have about an ⅛-inch gap. The top surface of the stabilizer then serves as a living hinge. It's important not to cut through the top surface.

After I had formed the elevators, I inserted dowels into the flutes in the elevators. I then drilled the dowels to receive the elevator joiner wire and installed the control horn.

The vertical stabilizer was then built in the same manner.

This KnightHawk has the tactical operations module (TO-POD) installed.

FUSELAGE FINAL ASSEMBLY

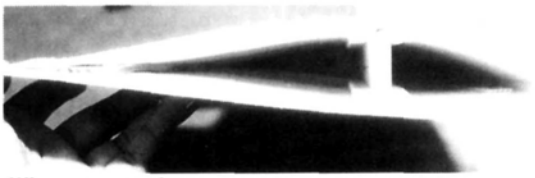
I aligned the horizontal stabilizer with the fuselage and then stuck it down with contact cement. I used a sheet of wax paper between the stab and the fuselage to give me a chance to line things up before the glue set.

Next, I inserted the vertical stabilizer into the slots in the fuselage and horizontal stab. I used a triangle to square up the stabilizer and cemented the vertical stab in place using silicone adhesive. After the adhesive had set, I trimmed off the excess material and added the trim strips to the front of both stabilizers.

LANDING GEAR

The landing gear was formed by sandwiching a 5/32-inch wire between two layers of Aircore®. The wire is slipped between two flutes in the top surface, and then the bottom surface is cemented on.

I placed the landing gear on the fuselage and drilled the mounting holes. The instructions stated to place the gear 14 inches from

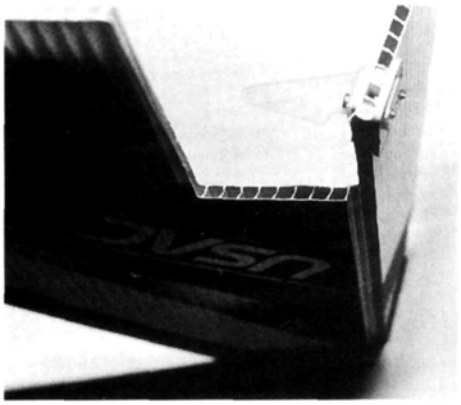


Wing cross-section.

the nose of the fuselage. I did this and later ran into trouble mounting the tactical operations pod. There are marks on the fuselage that indicate the gear-mounting position. These marks are in the correct places, and you should ignore the 14-inch measurement.

WING

The aileron hinge strips are made in the same manner as the elevator hinge. The aileron skins are glued over the hinge strips and naturally form a tapered shape. The hinge strips are then glued to the inside bottom surface of the wing. If you're going to use flaps, they'll be cut loose from the aileron later.



This detail of the Aircore® material shows the individual "flutes."

Next, I glued strips of Aircore® onto the inner surface of the wing skins. These strips are used to help align the spar. Then the other wing panel was built up to this stage.

I glued the spar into place between the alignment strips on both wing halves. I then installed the wing gussets, the doublers and the two wing ribs.

The leading edge of the wing has a series of score marks along its length. I heated the leading edge with a hair dryer so that it would bend more easily. I test-folded the wing top surface over the spar.

When I was sure that everything fit correctly, I added the contact cement and folded the wing. It's absolutely essential that the wing be glued along the spar from the tip in toward the root. If it's done any other way, an unwanted twist can result and ruin your whole day.

After both halves of the wing had been folded, I added the aileron torque rods. Then I wrapped the wing center section with a decorative piece of Aircore®, which also holds the torque rods in place.

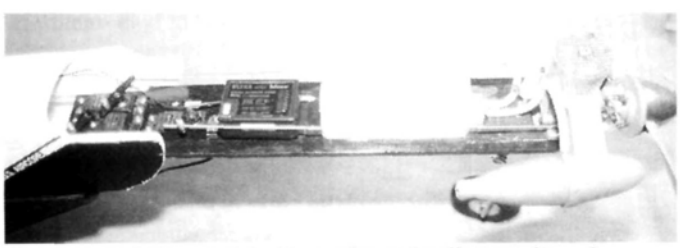
The aerial recon module has been installed. Velcro®-brand fasteners and rubber bands hold the Keystone Easy Shot 50 camera in place. When it's actuated by the servo, the white lever depresses the shutter button. This unit sits in the TO-POD.

I made the servo cutouts and installed the aileron extension wires and servos. Because I was using a computer radio, I decided to install a separate servo for each aileron and a single servo for the flaps.

The last step in the wing construction is to check for warps. This was done by placing the wing on an armchair and sighting down the trailing edge. Luckily, there weren't any warps present in my wing, but if there had been, I could have de-laminated the wing using lacquer thinner and a butter knife.

One point of interest on the wing is that when it's folded, the airfoil that's produced is slightly under-cambered. This undercamber may explain the surprising lift you get from the plane.

Because the basic airframe was complete, I skipped ahead a few steps and fuelproofed the finish with a clear coat of Black Baron* spray epoxy.



The power cartridge contains the engine and radio gear. It can be transferred to any U.S. Aircore plane. The Fox .50 engine is fed by an 8-ounce Sullivan tank.*

MOTOR INSTALLATION

Perhaps the most novel feature of the Knight Hawk is that you can remove the engine and radio from the plane in about 2 minutes. This is accomplished by means of a special power cartridge. The PC is a plywood unit that holds the engine, the fuel tank, the radio gear and the nose gear. The PC slides in and out of the fuselage on rails and is held in place with four screws.

Each plane that's designed by U.S. Aircore uses a PC. Therefore, if you own more than one Aircore plane, you won't have to buy a separate engine and radio for each one. Simply slip out the PC, install it in the other plane and fly. U.S. Aircore planes are all PC compatible.

One nice side benefit of the slide-in PC is that you can easily adjust the CG of the

SPECIFICATIONS

Kit name: KnightHawk
Manufacturer: U.S. Aircore Inc.
List price: $169.95
Construction material: Aircore®—corrugated polypropylene
Type: all-weather, sport/utility, multi-mission (AWSUMM) airplane
Wingspan: 64 in.
Chord: 11.75 in.
Length: 43 in.
Weight: 5.75 lb.
Mission weight: up to 9 lb.
Wing area: 752 sq. in.
Wing loading: 17.62 oz./sq. ft.
Power req'd: .40 to .50 ball-bearing 2-stroke or .48 to .50 4-stroke
Engine used: Fox .50
No. of channels req'd: 4 to 8
Radio used: Futaba* FP-7UHF
Assembly time: 3 to 4 evenings
First impressions: sturdy; so ugly it's cute.

Comments: the kit includes aircraft ply and lite-ply; 2-, 4- and 6-mil Aircore® corrugated plastic; all the hardware except the wheels, the throttle linkage and the fuel tubing; and an impressive, 39-page, illustrated manual, including 14 photographs and exploded views.

Hits
- Durable construction.
- Stable flier.
- Unmatched versatility.
- Excellent instructions.

Misses
- Long control rods not supplied.
- Landing-gear instructions (see text).

plane. Simply slide the PC forward or backward until the plane balances. Nice.

I did have two minor gripes with the PC. It's very long, and special threaded rods are needed to connect it to the throttle and nose wheel. The instructions don't mention this during this section, but they do mention it earlier. I had to wait for the hobby shop to open to get new, longer pushrods.

I discussed this with George Barker of U.S. Aircore, and he explained that longer pushrods weren't included because different engines and servo setups have different length and connection requirements.

The other gripe is that the radio on/off switch can't be easily mounted on the PC without gluing the switch to the cartridge. This wouldn't be a problem if you intend to leave your radio gear in the plane. I switch radio gear around quite a bit, so this is inconvenient for me.

RADIO INSTALLATION

The elevator, rudder and throttle servos are all installed at the rear of the power cartridge. I used larger control horns on the rudder and elevator servos to ensure adequate throw. I used long threaded rods that have clevises on one end and Z-bends on the other for the throttle and nose-wheel connections. I used EZ* connectors on the elevator and rudder servos to ease the removal of the PC.

The receiver and battery are held in place on the PC with Velcro®-brand fasteners. The plans show the receiver on top of the PC and the battery on the bottom. I changed their positions to allow better clearance of the PC and the front former. Depending on your receiver size, your particular installation may not require this.

With the radio gear installed on the PC, the CG can be adjusted. First, I installed the PC in the nose of the plane, and then I mounted the wing. I slid the PC around until the plane balanced at the location indicated on the plans. I then locked the PC in place with four, ½-inch wood screws, connected the elevator and rudder pushrods and slid the receiver antenna into its tube.

TO-POD

The one thing that sets the KnightHawk apart from other planes is its ability to carry out many different missions through the use of the tactical operations pod (TO-POD—pronounced "toe pod"). The TO-POD is a modular unit that is bolted between the main gear and allows you to mount various accessories to the plane.

The TO-POD can serve as a bomb-bay

(Continued on page 121)

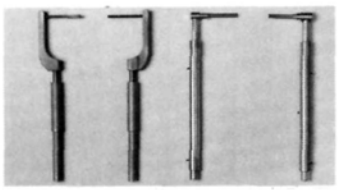
PRODUCT NEWS

R&R DISTRIBUTORS
Field-Box System

This field-box system is designed specifically for giant-scale airplanes. Made of solid oak, it features four large storage drawers, a prop drawer that will hold 26-inch propellers, large fuselage and wing holders and locking recessed latches. It's also fuelproof. The removable fuel and starter modules can be quickly connected, they're easy to carry, and they make it easy to fuel and start your plane on the flight line. The system includes a Royal power panel and a Sonic Tronic fuel pump. Specifications: dimensions—27.5x18x13 inches; weight—10 pounds.

Prices—$234.95 (kit form), $289.95 (assembled and ready to finish), $349.95 (stained and finished).

R&R Distributors Inc., P.O. Box 145, Wood Ridge, NJ 07075; (800) 752-1650 or (201) 804-0077.



FRANK TIANO ENTERPRISES
Landing-Gear Struts

These landing-gear struts are constructed of strong aluminum and steel and feature shock-absorbing action. They have a ½-inch-diameter end that allows them to be used in many different types of gear, e.g., the Bulldog, the Platt and the Barton. They come in two styles: the straight set measures 10 inches to the axle, and the offset type is available in 7½- or 10-inch lengths.

Price—$110/pair.

Frank Tiano Enterprises, 15300 Estancia Ln., West Palm Beach, FL 33414; (407) 795-6600.

MIDWEST PRODUCTS
Aero-Star .60

The Aero-Star .60 has the same simple structure as the Aero-Star .40, so it can be built quickly and easily. It's designed as either a jumbo-size trainer or a great sport flier, and it features easy-to-follow instructions and illustrations and full-size, computer-drawn plans. The kit includes a D-spar wing construction with hardwood spars; solid, shaped, balsa wingtips; fast-lock tabs for quick and easy fuselage assembly; a hatch for easier access to the fuel tank and the fuel lines; and a self-adhesive decal sheet. Specifications: wingspan—74½ inches; wing area—955 square inches; flying weight—7¼ pounds; power required—.45 to .61 2-stroke or .50 to .90 4-stroke; radio—4-channel.

Kit no.—178; **price**—$179.95.

Midwest Products Co., 400 S. Indiana St., Hobart, IN 46342; (219) 942-1134.

COVERITE
21st Century Iron

Only the 21st Century iron has a built-in temperature-control system. Simply set the dial to the desired temperature. The temperature processing indicator (TPI) lights as the iron temperature rises to reach the dial setting. The TPI blinks when the set temperature is reached to tell you that it's time to cover. No more guesswork! It has a unique shoe design that will get into hard-to-reach places, and its fully contoured shape won't create dents during application.

Part no.—6500; **price**—$39.95.

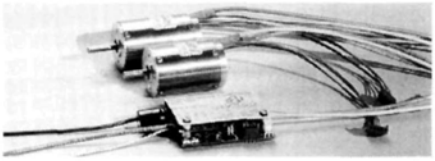
Coverite, 420 Babylon Rd., Horsham, PA 19044; (215) 672-6720.

TELSTAR VIDEO PRODUCTIONS
Top Gun U.K.

This 90-minute video has exclusive coverage of Europe's premier ducted-fan competition held in Somerset, England. It includes an interview with Mike Koskela, who flew a Harrier VTOL, and it features Chris Golds' Handley Page Victor. This aircraft has a 120-inch wingspan, weighs 53 pounds and is powered by four Rossi 90s and ByroJet fans.

Price—$24.95 (plus $2.50 S&H).

Telstar Video Productions, 1501 S.E. Decker Ave. #109, Stuart, FL 34994; (800) 972-4847 or (407) 286-2535.



AVEOX INC.
Brushless DC Motors

Aveox brushless DC motors are precision-machined of stainless steel and aluminum. They work by spinning the magnet on the shaft while the windings are fixed to the case. A special three-phase alternating-current controller switches electricity in the windings to keep the magnet spinning. The result is a much more powerful motor that never requires maintenance, has no brush arcing or heat loss and gives longer run times. There aren't any brushes to wear out or cause electrical noise.

Aveox Inc., P.O. Box 1287, Agoura Hills, CA 91376-1287; (818) 597-8915. ■

Descriptions of products appearing in these pages were derived from press releases by the manufacturers and/or their advertising agencies. The information given here does not constitute endorsement by **Model Airplane News**, nor guarantee product performance. When writing to the manufacturer about any product described here, be sure to mention that you read about it in **Model Airplane News**.

Manufacturers! To have your products featured here, address the press releases to **Model Airplane News,** attention: Julie Soriano.

NEW HELI PRODUCTS

HIROBO
Shuttle ZXX

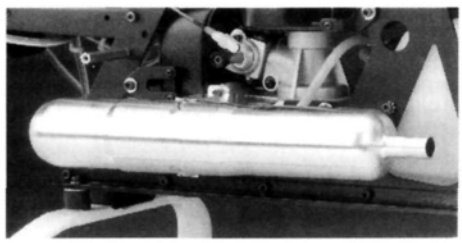
This .30-size helicopter shares the features of the 1994 versions of the Z and the ZX, such as collective-pitch levers that are on the exterior to permit direct access and easier adjustment, and tail blades that are enlarged for greater tail control. There's an improved pulley with a high-performance cooling fan and a universal engine-to-fan/pulley mounting system for easier adaptation of your favorite engine and quicker alignment. The Shuttle ZXX offers new features, such as main blade holders with integrated pitch arms and thrust bearings for faster, more precise pitch control; a swashplate with an aluminum upper plate and stainless-steel replaceable pivot balls; and a radius-arm assembly for accurate cyclic control.

Part nos.—0402904 (Shuttle ZXX unassembled kit without engine); 0402911 (Shuttle ZXX ARF with Enya SS35 heli engine installed); **prices**—$619, $859.

Hirobo; distributed by Altech Marketing, P.O. Box 391, Edison, NJ 08818-0391; (908) 248-8738.

KSJ
N-60RS Competition Muffler

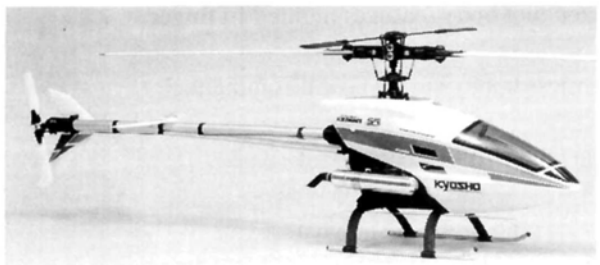
The N-60RS Competition Muffler is completely machined from bar-stock aluminum, which enhances overall durability and appearance. The muffler's four, machined-aluminum cylinders are screwed together, rather than welded. This eliminates any chance of fractures that sometimes develop around welds. A specially shaped internal baffle drastically reduces noise without inhibiting overall power. An engine coupled with the N-60RS produces smooth, steady idle in hover and more power in forward flight. The N-60RS is very easy to tune and works well with a wide range of fuels.



Because of the muffler's bolt-on design, fliers no longer have to bother with special clamps or silicone couplers that can burn out; just screw the N-60RS directly onto the exhaust outlet of the engine. Two versions of the muffler allow you to use it with the most popular heli engines, and both styles are easy to install on the X-Cell 60, X-Cell 60 Custom, Kalt, Hirobo and TSK helicopters.

Part nos.—KSJ213 (for O.S. engines), KSJ213Y (for YS engines); **price**—$129.95.

KSJ; distributed by Horizon Hobby Distributors, 4105 Fieldstone Rd., Champaign, IL 61821; (217) 355-9511.



KYOSHO
Concept 60 SR

The Concept 60 SR combines the best features of the original Concept 60, including durability and ease of maintenance. It has a flapping-type rigid rotor head that's outfitted with ball bearings; one-piece blade grips and metal side plates; push/pull linkages on the aileron and the elevator; and a direct collective-pitch linkage. It also has a larger, lower main mast bearing; a high-grade aluminum swashplate; expert main rotor blades; and a low-rpm clutch drum.

Part no.—KYOE0295; **price**—$899.99.

Kyosho; distributed by Great Planes Model Distributors, P.O. Box 9021, Champaign, IL 61826-9021; (217) 398-6300.

Descriptions of new products appearing on this page were derived from press releases supplied by the manufacturers and/or their advertising agencies. The information given here does not constitute an endorsement by **Model Airplane News**, nor does it guarantee product performance or safety.

PRODUCT REVIEW

The new Top Flite balancer in action. List price: $26.99

THE TOP FLITE PRECISION

Magnetic Balancer

A STEP FORWARD

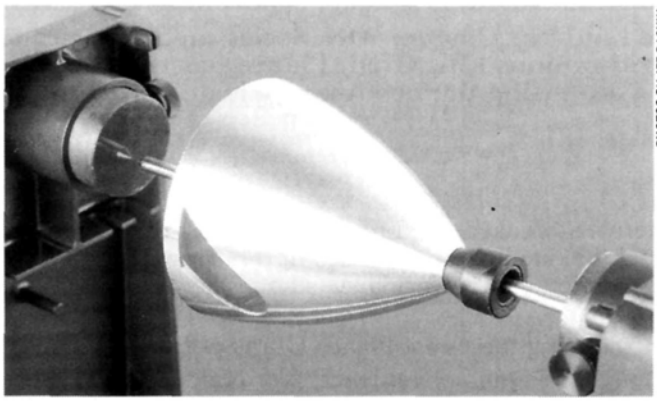
by JEF RASKIN

THERE ARE GOOD products and bad products in the model industry, but most are good-enough products. Every now and then, one with originality and fine engineering rises above good enough to the really fine. The much touted (by its manufacturer) magnetic prop balancer by Top Flite* (patent pending) deserves the hoopla. Mark McCormack's idea to use a pointed shaft suspended between magnets is clever. The shaft touches at only one point, and that's steel against a hard-as-iron magnet. The other end floats securely in midair!

It is far more sensitive than anything comparably convenient—a real benefit to the modeler who wants the last bit of smoothness in rotating components, but there are a host of design touches that make it something even more special. For example, it is both larger and smaller than most other balancers I have used.

• You can balance a wheel with a diameter of 11 inches and props up to about 24 inches in diameter. This is much bigger than most balancers allow.

• It folds up into a compact, well-protected case. I think that its inventor and the engineers at Top Flite had fun with this one. Its use, in conjunction with a tachometer, as a wind-speed measuring device (anemometer) is noteworthy; read the instructions to see how it's done. The instruction manual is unusually complete, detailed and worth reading.



PHOTOS BY JEF RASKIN

One end of the balance shaft actually floats in the air without touching the surface of the magnet.

ASSEMBLY

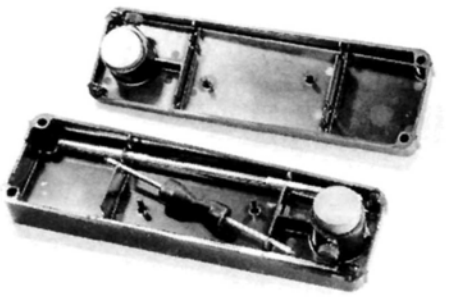
You have to prepare the faces of the magnets before use. You can do it the easy way and apply the supplied plastic faces with CA glue, or you can do it the hard way and polish them. I chose to put plastic on one pair of ends and polished the other ends to compare performance. Neither task is difficult; polishing took me some 15 minutes by hand. Putting the base together is a trivial matter of pressing metal rods into plastic holes. For maximum sensitivity, the instructions state, you can balance the tiny, lightweight plastic cones. I got them just so far, but a minute imbalance in the shaft itself swamped the final imbalance in the cones. To have tried to go further would have been persnickety.

LIMITATIONS

The magnets can hold a weight of about 5.5 ounces maximum. This can prevent you from weighing some things such as larger wheels and props over 24 inches in diameter that would otherwise fit in (or across) the balancer. The maximum hole diameter is ½ inch. It would be easy and inexpensive for Top Flite to provide larger cones so that you could balance tires and other objects with large central openings. The residual imbalance in the shaft means that you must make a mark on both the shaft and the object and align them if your balancing is to be more consistent. But this is no more accurate since you still don't know where the imbalance lies. The bottom line for me is that props that seemed to be balanced on other balancers showed an imbalance on the Top Flite unit. After rebalancing on the Top Flite balancer (any orientation to shaft), they all still rested level on the other testers. In other words, the residual error left by the Top Flite unit was less than the minimum error detectable on the other units. It's not perfect, just the best I've tested.

TESTING

I compared the Top Flite balancer to a four-disk balancer that I've used for years.



This is how the parts get tucked into their box. They are so well protected that you can toss this most sensitive of balancers into your flight box without fear of harming it.

The test was simple: I took a wooden prop and balanced it on the old balancer until it would not rotate, indicating that it was balanced. Then I put it on the Top Flite balancer, which I set up with the plastic faces—its "worst" precision. One end of the prop dropped ¾ inch.

A bit of sanding on the heavy blade got it level again. I could see the effect of two light swipes of the 120-grit sanding block on the back of the prop tip. I also had to hold my breath as the slightest breeze would set the prop moving. The Top Flite balancer even showed that one side of the hub (perpendicular to the blade direction) was heavier than the other—an effect that the other prop balancer couldn't detect. Since it is not a good idea to whittle away at hubs (as the instructions point out), I added some drops of epoxy to the light side until the prop balanced any which way. It is clear that, as far as static balancing goes, this balancer is it. Using the polished face showed no advantages over the plastic faces in my tests.

WISH LIST

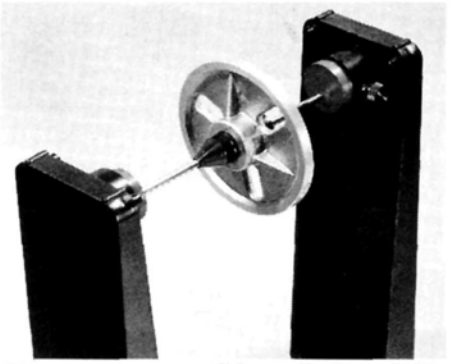
The Top Flite balancer is up to any modeling need I can think of, and beyond most of them in terms of precision. It proved so good that I began to think of what else I'd like to see. It is a bit hard to disassemble for packing: the rods in the base are a very tight fit, and I have to carefully use a pair of pliers to take mine apart. I found it impossible to get the provided shaft balanced: either it has a slight bend that I couldn't detect, or perhaps the points aren't exactly centered. This tiny imbalance would not be detectable except on this balancer and did not affect balancing propellers.

As the instructions warn, this shaft is of a very soft steel (for its magnetic properties), and unlike the music wire modelers are more familiar with, it will readily bend with finger pressure.

I would have liked to have seen a second, thinner shaft and smaller cones, for balancing parts in which the hole is too small for the provided shaft. Most of my free-flight propellers and smaller wheels fall into the category of things you can't balance. I made a few thin shafts of ordinary music wire, since the parts they would be balancing are generally lighter, and the magnetic properties of the steel are not as critical. Since I could not make cones for them, I just made the shafts in the exact sizes I needed, e.g., the size of a shaft for a rubber motor prop. I'd also like to see Top Flite offer a pair of optional neodymium magnets, which are considerably stronger than the magnets provided. This would allow balancing of heavier objects such as larger fan-jet fans. Rumor has it that a line of accessories is in the works.

SUMMARY

This is a topnotch piece of equipment, and it would be hard to beat for precision and convenience. It is also fun on your desk as a sculpture. (A balanced metal disk will spin for a long time!) Unusual for a sensitive, precision device, it is not troublesome, nor does it require careful setup or especially careful handling (except for the soft steel shaft). It should last indefinitely, even knocking around in your field box, which is probably why they have a five-year guarantee on this remarkable gem.



There are many possible applications in the hobby for this new balancer. You can also use "homemade" music wire shafts for very small items.

**Here's the address of the company that's featured in this article:*
Top Flite Models; *distributed by Great Planes Model Distributors, P.O. Box 9021, Champaign, IL 61826.* ■

HOW TO

Make a Mousse-Can Muffler

by JERRY L. SMITH & DAVID PAESSLER

A SIMPLE, LOW-COST, LIGHTWEIGHT, POWER-BOOSTING DESIGN

THIS MUFFLER WAS designed to fill a specific need in the fun-fly area. We needed maximum power, minimal noise, light weight and reliable operation. The following project fills these needs for fun-fly operations and is also very useful in most sport or scale applications.

For fun-fly use, we needed a powerplant that had a broad, even power band and was easy to set up and reliable to operate. This excluded most tuned pipes, as they become very nonlinear as they come on the pipe. Commercial mufflers were too heavy and cut power output. This muffler operates similar to the Irvine* Silencer, which was too heavy for our use. It is a tuned exhaust system that is much more linear than a pipe.

Owing to the construction materials, it is lightweight. With the back pressure required to tune the system, it is also fairly quiet. The project worked; now it was time to fine-tune it. This project has been thought out to be as simple as possible, as the average life of a fun-fly airplane is not very long. You don't want to spend too much time or money on any one area!

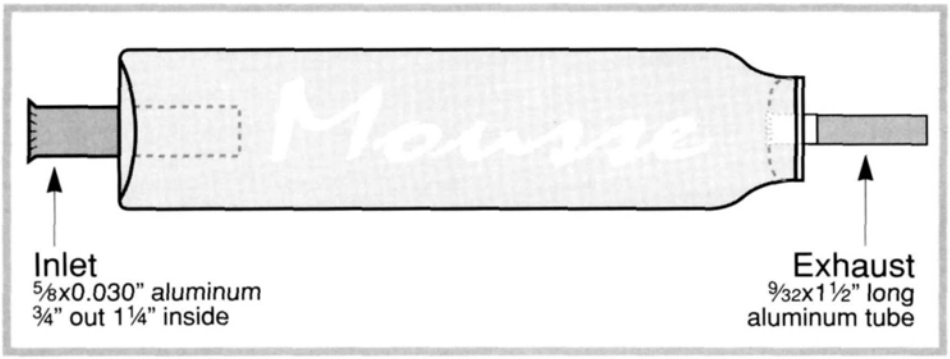
To simplify how this muffler works requires a little understanding of tuned pipes. Boosting a 2-cycle engine requires pressurizing the charged cylinder above atmospheric pressure. There is an easy way to do this. The tuned exhaust uses the mass of hot exhaust gas flowing out of the cylinder to draw some of the new fuel/air charge into the exhaust system. At some point, the exhaust gas encounters some restriction that creates a shock wave to reverse the flow of exhaust out of the cylinder. This forces the unburned fuel/air mixture drawn into the exhaust back into the cylinder, compressing it in the process. Thus, you end up with a fuel/air mixture that's higher than atmospheric pressure. I know that this is simplified, but it is an adequate explanation for most people to understand the concept involved. That is why the exhaust tube is much smaller than the intake tube on the muffler—to create the restriction for the shock wave to form.

Co-author Jerry Smith poses with one of his award-winning competition fun-fly designs. He took top honors with this plane at the '93 Fun Fly NATS (see our February issue).

The important issue is to make the header the proper length to create a beneficial shock wave. That is why it is described as a tuned exhaust. You tune it to the rpm you want for maximum performance. The shape of the can determines the maximum efficiency and broadness of the power enhancement. The tuned pipe is shaped to give maximum power at the sacrifice of linear power. The can we use sacrifices maximum possible power for a broad power band (near linear power). This is what we want for most fun flying and almost all sport flying. It also works well on scale projects, plus you can construct your own muffler to fit the confines of a particular model.

A quick guide to tuning is to start a little long and shorten the header in ¼-inch increments until rpm reaches a max. Then lengthen it ¼ inch. Too short a header causes the needle to be overly sensitive to adjustments. Too long a header just doesn't develop maximum power. If a radical prop change is made, the exhaust system will have to be re-tuned for proper operation.

The first mufflers were constructed of aluminum flashing. They proved to be difficult to weld together, and when J-B Weld was used, they tended to leak a lot. Jerry hit on the use of existing cans shaped like what we were making. A trip to the local Kmart revealed a wealth of products with appropriate containers. This step cut labor greatly and was a boost to reliability, as there were now only two joints to seal.



Local sources for materials were found for almost everything, as hobby-specific items tend to cost more. The descriptions of the following mufflers are specific to the HP* 40 (props—10x6, 11x4), Webra* 32, O.S.* 32 and Enya* 35 (10x4, 10x5), using appropriate props. This should cover most sport and fun-fly applications. The real beauty of this approach is the cheapness of the project. You can experiment on many different designs to find what is best without spending a fortune. The only hobby-store items you will need are the engine header and some silicone pipe coupling. The header has to be welded together as temperatures are extremely high at the exhaust port. Farther downstream, temperatures are low enough to use the J-B Weld to assemble components.

Let's get to the building of a muffler! The photos tell the story.

1

START BY COLLECTING THE ITEMS SHOWN.

- *J-B Weld part no. 8265-S (found locally at a True Value store).*
- *5/8-inch-diameter, .030-inch-thick aluminum tube (True Value clothesline prop, item 54K1, 061-628-8492; 7 feet long).*
- *9/32-inch-diameter aluminum tube (K&S* Engineering, stock no. 107; hobby-shop item if unavailable elsewhere).*
- *Tapered cone x 1 3/8-inch rotary rasp (True Value, item no. 110-502).*
- *Can: White Rain styling mousse, 5 ounces, 1 3/4x6 1/2 inches, or Scripto butane fuel, 2.1 ounces, 1 3/8x5 1/2 inches. (Note: the White Rain can is preferred as it is easier to tune.)*

2 *Cut a 2-inch-long piece off the 5/8-inch tube and a 1 1/2-inch-long piece off the 9/32-inch tube. Using a pair of pliers, flare one end of each tube. (The large tube needs just a little, but flare the little tube quite a bit.) Scruff each tube in the gluing area with 100-grit sandpaper.*

3 *Next, prepare the White Rain can for use by thoroughly emptying the container. Then, prick a pilot hole in the center of the bottom of the can. Drill a 1/4-inch hole. Using a rotary rasp, enlarge the 1/4-inch hole to 5/8 inch. Drill several 1/8-inch holes around the big center hole to aid the glue bond. Then sand around the glue area.*

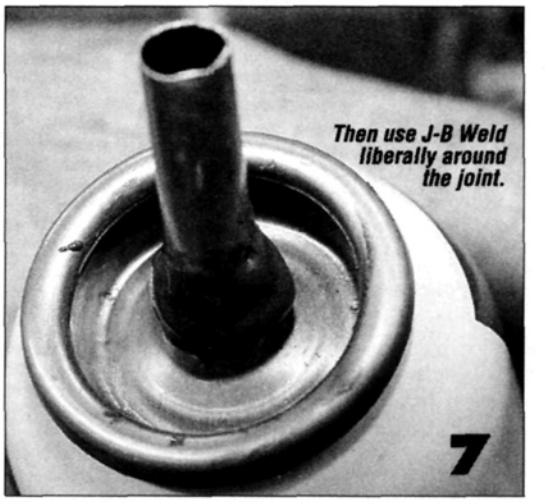
4 *Push out the top plastic dispenser through the bottom of the can. Drill out the top hole to 9/32 inch.*

Clean the can with warm soapy water, and dry it completely. Gather the components for assembly.

5

6

Feed the 9/32x1 1/2-inch exhaust tube through the bottom end of the can with the flange positioned to "lock" just inside the top of the can. The tube will protrude out of the hole in the top of the mousse can (see diagram). Guide the tube into place using a wire, as shown in the photo, and spot-glue it in place with one drop of thick CA.



Then use J-B Weld liberally around the joint.

7

8 ***Fit the larger tube into the bottom of the can with the flange on the outside. (The flange will help secure the silicone coupler.)***

If you do not have a tight fit, bend the sides of the hole inward so that they snug up on the tube.

10 ***Install the tube with a ¾-inch portion sticking out, and glue the tube in with J-B Weld. (Note: let the assembly dry for at least 24 hours in a warm place before you use it.)***

11 ***Mount the larger pipe extending from the mousse can to your header with a silicone coupler, and tie-wrap the silicone to secure it. Mount the body loosely with a tie-wrap to prevent vibration from shaking it apart.***

If you use a pressure tap, place it on the header in a high-pressure area, as shown.

The finished weight for the White Rain muffler will be about 2 ounces and for the Scripto butane can, 1½ ounces. The Scripto can muffler will produce more power, but it is a little more sensitive to tuning. The White Rain muffler, built as shown, coupled to a header, i.e., cut so that the distance from the exhaust flange to the cut end is 3 inches, will give good results with the noted motor/prop combinations. The Scripto can is built in the same way. Its smaller volume makes it a little more powerful but a little more sensitive to tuning.

13 ***Experiment with different configurations and packages to see what they will do. We have built several multi-chamber mufflers to combat noise levels—with varying success. Look again at everyday items for alternate uses; you just never know what you will find!***

**Here are the addresses of the companies mentioned in this article:*

Irvine; *distributed by Great Planes Model Distributors, P.O. Box 9021, Champaign, IL 61826.*

HP; *distributed by RJL Enterprises, 1831 Business Center Dr., Duarte, CA 91010.*

Webra; *distributed by Horizon Hobby Distributors, P.O. Box 3726, Champaign, IL 61826.*

O.S./Great Planes Model Distributors, *P.O. Box 9021, Champaign, IL 61826.*

Enya Model Engines/Altech, *P.O. Box 391, Edison, NJ 08818-0391.*

K&S Engineering, *6917 W. 59th St., Chicago, IL 60638.* ■

GOLDEN AGE OF R/C

HAL DeBOLT

REBEL R/C'ERS TO LW SENIORS

IT'S CATCH-UP time again here at "Golden Age." Your input keeps coming, and, amazingly, very little is duplicated. This really demonstrates the depth of our R/C sport, certainly the knowledge must be extensive; we are far beyond the come-and-go stage.

MORE ON RALPH BROOKE

Let's commence with some additions to our "Doc" Ralph Brooke tribute. "Hobie" Martin, now of Irving, TX, tells us that he began his R/C journey in Seattle in the '60s with a Kraft-equipped LW Champion that was powered by an O.S. 19. He says that the Champ flew extremely well and even survived his learning crashes!

Hobie met Doc Brooke at a club meeting and found him to be, as most of us did, straightforward, opinionated and a standout club leader. His booming voice and hearty laugh were sharp contrasts to any shortcoming. After all, it was Doc proclaiming his thoughts, and he was the world champ!

A.J. Johnson enters his enlarged Blitzkrieg in a SAM event. I hear that the big one is a good performance match for the original.

Model Airplane News takes us beyond the States and reaches worldwide. I received a letter from Alain Carrette, a 28-year Belgian who migrated to the British Virgin Islands. Alain's father was a dedicated modeler in Belgium, and Alain became involved in R/C when he was 13 years old. He says that the "love story" continues to this day. Alain tells us that "Golden Age" is

John Scott's ½A-size Blitzkrieg in a SAM Texaco event. Again, it performs like the original.

something like a time machine that takes him back to the questionable radios, the capricious engines that weren't very powerful or reliable and the slow-curing glues. He says that this column even smells like silk and dope! Something wrong with that?

Alain sent a photo of Ralph Brooke along with his tribute. Alain spotted the world-event "bib" that's attached to Doc's leg. Those contestant badges were the world champs' hallmark: large emblazoned cloths that, for lack of a better name, we called "bibs" (and looked for the spaghetti to go with them!). A sponsor usually supplied them, and, of course, they always included their logo along with the contestant number. Alain believes that the Doc's sponsor was a Belgian newspaper, *Het Nieuwsblad*. I'm happy to tell him that he's probably correct, as Ralph won his championship in Belgium.

CAPTION GAFFE

Regarding the tribute photo: I've said before, the way to get your attention is to pull a boo-boo. For some time, I've attempted to get info from Jerry Nelson about the beginning of Formula 1 pylon as he was its instigator; but so far, I've had no luck. The photo did get his attention, however! Deciphering these old photos can be perplexing at times. This one (published in the September '93 issue) had a '65 Nats caption, which seemed logical, considering the people in it.

Jerry informs us that the photo was taken at the Belgian World Championships; seeing how his "purty face" graces it, he should know! I beg his and your pardons for that one.

REBEL R/C'ERS

On another note, John Shannonhouse of Forest Park, GA, fills us in with news of some of the prominent OT Rebel R/C'ers with whom many of us were proud to be friendly. John informs us that pattern expert Harold Colson never woke up one morning. That followed the loss of Al Pinson. Remember Al's little Mercedes convertible and the trailer behind it that carried his models? And the complete workshop in the little trailer?

John also tells us a cute story about Al Pinson at a Nats. Flying with his Bramco reeds, Al lost one channel in flight (remember that each control direction required one channel, so losing one wasn't always a catastrophe). He proceeded to remove the cover of his "stick box" so that he could "tune" the lost channel in while the model was on its merry way! He did it, too!

On a brighter note, John says that other Rebel R/C'ers, such as D.C. May

Colin McKinley with his recently completed electric-powered LW Senior from Bill Weaver plans. Note the Pro-Line radio used; it's still one of the finest. He says that the Senior is a realistic flier.

and Tom Baker, are still hard at it. The North Carolina R/C group was a cornerstone of early R/C.

Walt Good with his TTPW at an early North Carolina R/C meeting. Note the large spectator interest in so few models. Walt had a dipole antenna; the others are whips. Walt amplified his transmitter output so that everyone could hear the jargon! (from Charlie Spear's photo collection).

REMEMBER WHEN?

We've all heard the early day "tuning stories" that usually involved transmitter and receiver radio frequencies. The advent of reeds took us far beyond that, however. For a safe day's flying, you needed to check the transmitter RF output, the associated receiver RF input and then tune each transmitter audio channel to the correlating receiver reed (there could be 10 of them!). Then you checked and adjusted the reed contacts and followed that by cleaning and adjusting the relay contacts (there could be *20* of them!). But *before* all this, you had closely checked and/or replaced the dry batteries, right? So, you can see that Al's problem was only one link in a long chain. Too bad we only have to occasionally range-check today, isn't it? How boring it is. How spoiled we've become!

CHAIN OF EVENTS

Let's briefly follow that chain to understand how the reed system, which brought multi to the masses, worked. First, as with all radios, there was a radio frequency (your 72MHz spot now). Up to 10 audio tones, whose frequencies were adjustable in the transmitter, were sent over this "carrier." One tone was for each control direction. The receiver's RF section accepted the carrier over which one tone at a time could be transmitted. I should qualify this by saying that by the end of the reed system, simultaneous tones could be sent—in a way, that is. The receiver reed bank consisted of separate reeds, each of which would respond to a specific tone, each separated by a few cycles. When a transmitter tone was matched to a particular reed-vibration frequency, the reed closed contact by vibrating against it. This contact was in a separate relay circuit, and with the circuit energized by the reed closure, the open relay contact closed. This caused

O PIONEERS!

I hope that you enjoyed last month's discussion of Dickerson's extensive report on the B&D propo system (as featured in *Model Airplane News* many years ago). Apparently, many of them were assembled. I hope that some of you will tell us of your experiences with the B&D; photos are a great help.

Relating to the B&D is a fine letter from John Rawlings of St. Peters, MO. John is a classic OT'er who blossomed when R/C was seeded. He tells us of the many midnight hours he spent assembling R/C equipment when none was commercially available. As equipment became more complex, a major problem developed with the "hardware" needed to complement the electronics. The connectors, printed circuits, servo gear-trains, motors, etc., that are common today weren't available then.

An early unknown pilot straps the wing onto his LW Senior. Note the rubber-band-mounted landing gear. In the event of a rough landing, which was expected in those early days, the gear would simply fly off! (from Charlie Spear's photo collection).

As with all multi systems, it was the control-stick and gimbal. John was a great aid by manufacturing and supplying the necessary machined parts. He says that he sold more than 4,800 of his "Pro-Trol" gimbal units. This testified to the popularity of the B&D system. The surprise was that he still had a NIB Pro-Trol to send me!

Don Dickerson included interesting comments about the Good TTPW system that led him to the B&D. Apparently, he soon discovered why the two-tone pulse-width system was humorously labeled "too tough to piddle with." It's strange that his major finding paralleled my own experiences developing an early "tuned relay" system. Both systems suffered from good days when all was great and bad ones when the best operation was marginal. We both finally correlated the problem with weather, of all things. When was the last time that weather affected your modern radio? It seemed that the problem only surfaced at the field on hot and/or humid days; the good days were mild and dry. Both systems used selenium rectifiers, and simply put, substituting mil-spec silicon diodes for them cured the problem. Now some of you TTPW piddlers know the cause of some of your frustration! Did we ever have to learn so much the hard way?

Another vexing problem was the contamination of the Sigma 4F transmitter pulsing relay contacts. Don cured this by substituting gold for the silver contacts used by Sigma.

The bottom line: these are just examples of the growing pains R/C went through to get where it is today. There were many as the virgin territory of R/C was explored. Perhaps you can imagine the temptation to work longer and harder when a successful flight was finally achieved—something as simple as a successful launch, a few controlled turns followed by landing without breaking the prop. Maybe even a duplicate that day! We owe so much to the pioneers who diligently laid the groundwork for today's R/C!

the associated servo to travel to one extreme. When the transmitter stick was returned to its neutral position, the tone ceased, the reed quit vibrating, the relay contact opened and the relay returned to its regular closed position; this engaged the servo's neutralizing circuit. All this had to happen correctly *each* time you wanted any control to move! It's a marvel that the system worked as well as it did with all the tuning and contacts involved—a picture of complexity!

CRUISERS AND CORVETTES

One of the LW designs I get a lot of inquiries about is the LW Senior. It always raises a question in my mind. I know that it was the first LW, but it was also the least produced. Only 250 Senior kits were made, yet I know of a modeler who recently acquired a Senior kit, built it and now enjoys flying it. At about the time the Senior was thought of, Chevrolet conceived the "Corvette." They had doubts about its "saleability," so they made a "trial" run of them, and you know the consequence. Naturally, the production version was "dolled up," so to speak.

Dmeco and R/C were in the same kettle of fish. Like Chevy, when those first Senior kits flew out the door, Dmeco knew something had to be done. The Senior kits were hand-fabricated—no tooling—and the plans were just blueprints. So, the answer was a dolled up and tooled up Senior labeled the "Cruiser," which had printed plans. Like the Corvette, many thousands of Cruisers were produced to fill the R/C skies.

SENIOR PLANS

All this leads to LW guru Bill Weaver, who has built and flown every LW ever kitted and still has a stable of them flying! What a guy! A few years ago, Bill took the time to trace the Senior plan blueprint onto plastic film so that it could be reproduced. It was so well done that I couldn't tell the copy from the original. Now, Bill tells us that, only by word of mouth, he has supplied 14 copies to people country-wide (plus some overseas and some to the AMA museum library). The point is, do you want a Senior plan? Bill may be of help. Write to him at P.O. Box 373, Middletown, MD 21769.

(Continued on page 126)

CENTER ON LIFT

MICHAEL LACHOWSKI

MEASURING FLIGHT PERFORMANCE

THE MEASUREMENT and analysis of our sailplanes and their performance provides us with real data to compare models, pilots and flying techniques. This month, I'll discuss a watch that, in addition to keeping time and monitoring weather trends, can be used to take a variety of measurements of a sailplane's flight performance. To help analyze models prior to construction, you'll need some background information on how to do this and computer programs to make it easy. SoarTech* 10 is now available and is a good addition to your library if you like doing things that don't require going to the field to fly.

Although you don't need to have a computer to build a good sailplane, a poor radio installation will make even the best sailplane difficult to fly. In closing, I'll offer a tip on how to install servos in a narrow fuselage—the trick is to utilize the best geometry in the control-surface linkage.

THE ULTIMATE SOARING WATCH

Avocet* makes an "electronic wrist instrument" that is perfect for use in soaring. The Avocet Veritech Alpine watch includes an altimeter that provides a variety of measurements, such as maximum altitude, ascent rate and total ascent. It also has a great stopwatch with 20 split or lap memories. You might even want to use it to keep time.

The altimeter is potentially more useful to modelers than those on the Casio watches you have probably seen. This altimeter measures in increments of 10 feet. What distinguishes this watch from other altimeter watches is the other altitude-related functions it incorporates. Besides measuring the current altitude, you can have the watch store the maximum altitude. After you reset the maximum, the watch samples the current altitude and records the new maximum altitude. You can use this to see how high you are launching with the

Although it's designed for skiing and hiking, the Avocet Veritech watch with its altimeter, climb rate, weather trends and stopwatch funtions make it an excellent watch for soaring enthusiasts.

SOARTECH NUMBER 10

SoarTech 10 is now available. For those of you who think SoarTech only means airfoil data, check out the topics covered in number ten. It includes such topics as molded sailplane construction, vision and soaring, symmetrical airfoils, an analysis of winch launches and wing loads and wing strength.

One very interesting article by Martin Bamert details his experiences in constructing an all-molded sailplane. It includes many pictures of mold construction and sailplane construction techniques. Of course, the pictures of the finished results at some beautiful flying sites in Switzerland are worth a look even if you never plan to undertake such a construction project.

For the computer junkies, four of the articles have computer programs to implement the ideas presented in the text. A disk containing these six programs is also available, so you don't have to re-key them into your computer. Some of these programs provide stability and control calculations that you might find to be an interesting addition to the normal performance calculations.

SoarTech 10 is the latest issue of this valuable journal. SoarTech articles cover all kinds of topics related to model sailplanes (most are too long to be published in model magazines).

SoarTech 10 is available now for $16 (U.S. addresses), and a disk with the programs is $12. Issues one through nine are still available. Contact Herk Stokely for more information on earlier issues and orders outside the U.S.

If you have SoarTech 8 and want to put all the data on your computer, data disks for "Airfoils at Low Speed" are also available for $12. These disks have all of the test data from the Princeton wind-tunnel tests stored in ASCII text files.

Another way to get this test data is to order the late David Fraser's "Sailplane Design" performance program. SoarTech is supplying Version 3.4 of the program, complete with the Princeton tests and several other sets of test data. It comes complete with an instruction manual for $35.

winch. For electric or old-timer pilots, this capability is handy for testing motor/propeller combinations.

With the altitude measurement, the watch can calculate ascent or descent rates and count the total number of ascents or descents. The most useful setup is the ski mode, which totals descents. In addition to the total, the watch counts the number of descents. You have to climb for a while before it adds another descent. This prevents the watch from triggering descent counting if you climb only 10 feet. You can use this in a long flight to check how many thermals you were climbing in (number of descents), and the total descent will tell you how much altitude you gained in all of the thermals.

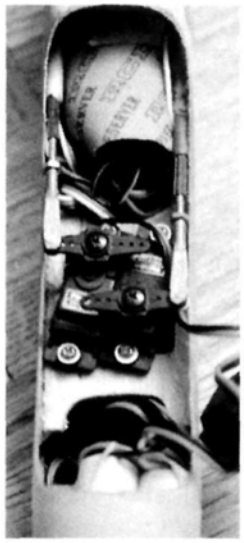
The weather functions can be handy during a day of soaring. Lock in the current barometric pressure in the morning, and then you can watch the trend during the day. The trend can tell you how quickly a front is passing, which might drastically change lift conditions. The watch does measure temperature, but this is useless if you *wear* the watch, since the temperature only tells you that you are still alive. (It's probably more useful to someone who is skiing and wearing the watch on the outside of a jacket.)

As a stopwatch, it's very good. You can store many splits if you fly F3b or F5b distance and speed tasks. Besides split memories, the watch can store your flights in memory and recall them later. You do this by storing the time after stopping the watch. Another function lets you recall and review each of these flight times. If you keep a flight logbook, you can use this watch to log all your flights for the day and then recall and write them down from the watch's memory.

All of this capability doesn't come very cheap. I've seen this watch priced in the $110 to $120 range. Your best source would be a store that has hiking or skiing equipment. Some bicycle shops also sell Avocet watches.

MOUNTING SERVOS IN NARROW FUSELAGES

Some glider fuselages are very narrow—often just wide enough for two microservos side by side. Since the servos are normally mounted in front of the receiver, the pushrods must run right along the fuselage side. When it comes time to attach the pushrod to the servo arm, you have to use a short arm to prevent the arm from rubbing against the fuselage.



These servos have been installed at an angle in my 2-meter Aeolus '93. The angle allows longer servo arms to be used.

Short arms on servos present problems in getting control surfaces to operate correctly. The short arm produces less movement of the pushrod. This short movement means that any slop in the linkage produces a greater amount of play in the control surface. It makes for a poor radio installation.

You can solve this problem by angling the servos in the fuselage. By turning the servos 15 degrees and staggering them slightly, the servo output shaft can be moved far enough away from the side of the fuselage to use a longer servo arm. Cut a custom plywood servo tray. Make it one piece if possible. Not only will you have more space for the arm, but you'll also have more gluing area and will enhance the strength of the fuselage.

**Here are the addresses of the companies mentioned in this article:*
SoarTech Journal, *Herk Stokely, 1504 N. Horseshoe Cir., Virginia Beach, VA 23451.*
Avocet, *8674 Thornton Ave., Newark, CA 94560; (800) 428-6238.* ■

video views

by JEF RASKIN

BIPLANE FEVER

Subject: *Biplanes, mostly those on the U.S. air-show circuit.*
Source: *AAF Museum, Box 7325, Thousand Oaks, CA 91359; Zenith Aviation Books, (800) 826-6600.*
Summary: *Biplanes, biplanes and more biplanes on the ground and in the air.*
List price: *$29.95 (plus S&H)*
Rating: ✈ ✈ ✈ ✈ ✈
Approximate length: *49 minutes*

There is an old saying that real airplanes have two wings, round engines and—I would add—wear pants (wheel pants, that is). I am more than partial to these birds and can't get enough of them. If you have the same addiction, then this tape will keep it well fed and possibly inspire a round of model building. Beginning with some historical footage, it concentrates on the biplanes flying today. There are a lot of them shown, nearly 30 different types in all. We see a lot of good footage, including flight shots of one of my all-time favorites, the quintessential Curtiss-Wright Speedwing. The interviews with pilots, owners and mechanics are brief and to the point.

Here's a partial cast of characters: Great Lakes, Waco EQC-6, Waco UPF7, Stampe, Tiger Moth, N3N, Jenny, J-1 Standard, Bristol Fighter, Sopwith 1½ Strutter, Fokker and Sopwith triplanes (shown in spite of having too many wings!), Travelair 2000, Boeing P12E, Grumman J2F Duck, Fleet trainer, Staggerwing Beech and the ubiquitous PT-17 and PT-13 Stearmans.

The tape ends with some well-taped biplane aerobatics, including a dramatic octagonal loop that begins and ends at ground level.

I should mention that when I measure the lengths of tapes, I exclude any ads at the beginning or the end. Thus, my timings are sometimes shorter than the manufacturers'. This tape starts off with a lot of ads for the AAF's other videos.

FLOAT-FLYING VIDEO

Subject: *Building floats and flying from the water.*
Source: *Zenith Aviation Books, (800) 826-6600.*
Summary: *Facts and techniques from an expert and fine float flying to watch.*
List price: *$29.95 (plus S&H)*
Rating: ✈ ✈ ✈ ✈ ✈
Approximate length: *116 minutes*

A wealth of experience in R/C float flying has been bottled up in this tape, which can be magically released by rubbing it against the rotating heads of a VCR. John Sullivan is well-known for his floats; he shows us how to build and finish them, how to mount them, and how they fly. There is no fancy production, not even titles at the beginning, just a friendly "Hello" and we're off and learning.

There is, on the other hand, lots of useful detail. For example: floats should be about 85 percent of fuselage length; the center-line distance between floats should be about 25 percent of the wingspan, with the bottom of the prop about 2 inches above and behind the tips of the floats (.10s and up); the step should be under the CG or very slightly behind it, while the top (deck) of the float should be parallel with the center line of the stab. A skilled modeler need be told no more

(Continued on page 126)

PIEZO GYRO

(Continued from page 78)

During the time I was testing the gyro, two of my flying buddies commented about how stable the helicopter was flying. So I said, "Here; you want to fly it?" While they were flying, I told them to turn the machine crosswind and even hover the machine downwind. They both commented on how easy the machine was to fly, regardless of wind direction. As for me, I'm about to burst trying to hold back the laughter, because at this time, no one knew that I had one of the only two prototype Piezo gyros imported by Horizon.

We all know that nothing is perfect and this, too, includes the Piezo gyro. Anything that offers this many advantages surely must have some drawbacks, and it does—price. With a list price of approximately $400, I found them for sale at my local hobby shop for $280. Compare this with JR's top mechanical gyro—the 120—which is listed at approximately $200 and for sale at the same hobby shop for $120.

Though the Piezo costs over twice as much as the 120, I think it's money well spent. Here's why: the weakest part of any mechanical gyro is the motor and the gimbal it pivots on. Sooner or later, all mechanical gyros will require that this area be repaired or replaced, and this costs money. With no moving parts, the Piezo should last forever—assuming you don't destroy it in a crash!

That brings me to another area—crashing. I have not crashed my Piezo, but two of my flying buddies have—one of them, twice. In all three cases, the Piezo survived and required no maintenance. One of these crashes was severe enough to break the machine's carbon-fiber side frames! Up front, the Piezo will set you back more than a typical gyro, but in the long run, the Piezo owner wins out.

So, if you're looking for a small, lightweight, low-drain gyro with truly state-of-the-art performance, try the patented Piezo Gyro from JR.

**Here's the address of the distributor featured in this article:*
Horizon Hobby Distributors, *P.O. Box 3726, Champaign, IL 61826; (217) 355-0022.* ■

KNIGHTHAWK

(Continued from page 93)

door module (BBDM), an all-weather module (HIWIND), or an aerial-recon module (ARM). The basic TO-POD remains unchanged in all these versions, but various features are easily added to or removed from it.

The BBDM creates a 50ci-payload bay in your TO-POD. The BBDM is a servo-controlled door that's attached to the TO-

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(Continued from page 6)

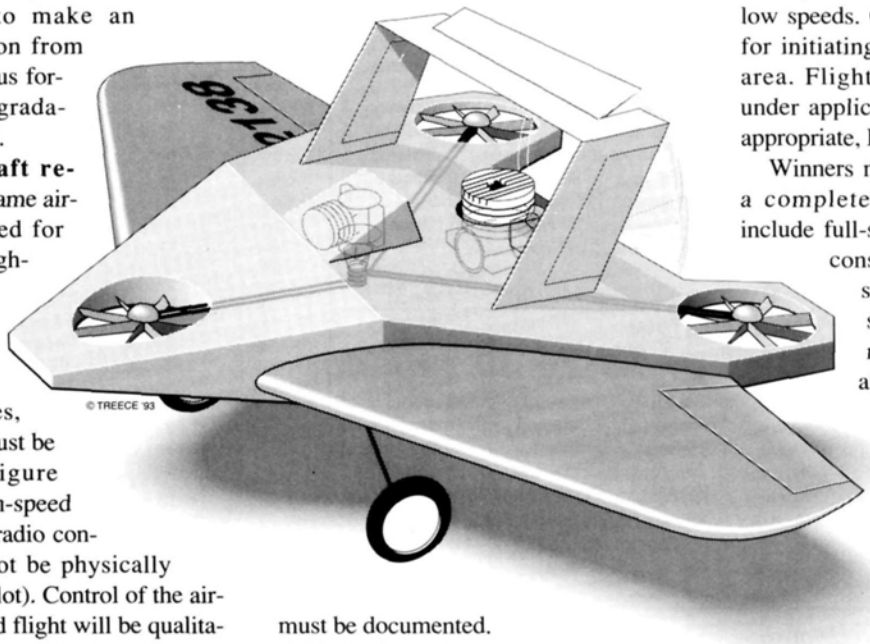
engine classes that weighs heavily in favor of slow flight but that also rewards total performance envelope. This system allocates 20 points per mph under 30mph, and two points per mph above 30mph. For example, if you can hover and fly in full control at any speed up to 50mph, you would earn 640 points.

Hovering is not a requirement. For a hover to count, it must be sustained for at least 30 seconds in zero wind conditions. For maximum points, the aircraft must be able to make an in-flight transition from hover to continuous forward motion at gradations of low speed.

3. Single aircraft requirement. The same aircraft must be used for both low- and high-speed runs. It is not required that the aircraft have low- and high-speed modes, but if it does, it must be able to reconfigure from low- to high-speed modes purely by radio control (wings cannot be physically replaced by the pilot). Control of the aircraft in slow-speed flight will be qualitatively assessed by the NASA and NACA/-NASA alumni panel based on video tapes submitted. (Do your best when documenting your flights; we hope the broadcast media will pick up a video of winning designs!)

4. Calculation of wing loading. Calculation of wing loading for purposes of this contest shall take into account the surface area of any wing, lifting body, or permanently mounted, fixed disk/fan that generates propulsive lift resulting from downward directed thrust. The swept area of a disk mounted within a rotating nacelle or on a conventional tilt wing configuration, i.e., that permits propeller thrust to be directed in a horizontal plane, shall not be included in the wing-loading calculation.

5. Wind speed. If, in a slow-speed run, the forward speed of the aircraft is less than the speed of the wind, the aircraft would fly backwards on the upwind leg. For the sake of accuracy in measuring performance, we recommend that testing be done in no-wind conditions or where the wind speed is less than the aircraft's speed. Prevailing wind conditions at the time of the record course run must be documented.



6. Exclusions. Helicopters are excluded. Nor are we looking for a demonstration of virtuosic flying technique whereby a competitor hangs a conventional R/C aircraft on a prop, and through brilliant coordination of thumbs, pilots the aircraft oh, so slowly through the course. Rather, this contest is intended to promote the development of novel designs that reliably enable the pilot to fly at very slow speeds with great control (and not purely as a function of eye/hand coordination). No lighter-than-air gas may be used. Aircraft in all three classes must fly at a height of at least one wingspan. Previously published designs are excluded.

7. Documentation. Entrants will need to provide a three-view, aircraft specifications (which will include a statement of performance), a description of the design (not to exceed two typed pages), still photos of the aircraft, a letter signed by a contest director (CD) and local club president, or equivalents (not all contestants may have the benefit of a local club!), and a videotape of the record flight tests. Be sure to include a detailed description of how the plane flies at very low speeds. Contestants are responsible for initiating flight tests in their local area. Flight tests will be conducted under applicable AMA (or, as may be appropriate, FAI) safety guidelines.

Winners must be prepared to submit a complete construction article to include full-size plans, black-and-white construction photos, a discussion of the construction steps and color slides of the model on the ground and airborne. Send the documentation of your entry to Julie Soriano, Managing Editor. (See below for address.) We advise that you send the package by certified mail. We will promptly confirm receipt of a submittal with a postcard.

8. Electric powerplants. The rules specify that the internal-combustion classes must have between .40 and .50ci displacement. This does not prohibit the use of additional electric motors that are employed to turn rotors or propellers.

For a copy of the rules as published to date, contact Julie Soriano, Managing Editor, Model Airplane News, 251 Danbury Road, Wilton, CT 06897. If you have specific questions relating to the contest, contact Tom Atwood at (203) 834-2900; fax (203) 762-9803; Internet address: toma@airage.com. ■

KNIGHTHAWK

(Continued from page 121)

POD with Velcro®-brand fasteners. The BBDM can be used to drop all sorts of payloads—paratroopers, bombs, candy, streamers, confetti, or just about anything else that will fit. A heavy-duty servo is recommended for this.

The HIWIND module is a ballast system—a bottle that's filled with water and strapped into the TO-POD—that allows you to fly in stronger winds. By varying the water content of the bottle, you can adjust the wing loading of the plane. The HIWIND module will hold up to 20 ounces of ballast directly below the CG.

The ARM allows you to mount a camera in the TO-POD and take aerial photographs. I used a fixed-focus, automatic camera—the Easy Shot 50 by Keystone. The Easy Shot 50 is an autowind 35mm camera with built-in flash, and it automatically sets the film speed, the aperture and the shutter speed. It's also about $10 cheaper than the Vivitar PS 44 camera that's recommended. This is an important feature, because the odds are good that you'll eventually crash your plane, and an inexpensive camera really helps cushion the blow (to your wallet). Both of these cameras can be had for less than $40 each. The ARM can also use disposable cameras, but you'll need to land between shots to advance the film.

The ARM consists of a plywood base with a foam-rubber cushion. A servo that's mounted on one side of the ARM drives a wire that's connected to the shutter actuator. When the actuator is depressed, it forces a screw into contact with the shutter button, and a picture is taken. The entire ARM is held in the TO-POD by rubber bands.

Another system included with the KnightHawk allows duration flights. The LRTS, or long-range tank system, consists of a bracket that holds two 12-ounce auxiliary tanks. I didn't try it, but it looked like a straightforward system.

FLYING

Test-flight day arrived with clouds and wind—not exactly the perfect test-flight weather, but fall in New York is seldom predictable.

After a quick range check, I fired up the Fox* .50 and ran a tank of fuel through it until I was satisfied with the idle. I did a few high-speed taxi runs to check the tracking. The KnightHawk tracked straight down the asphalt runway and promptly began to fly. Because I was already airborne, I advanced the throttle and climbed for altitude. I brought the KnightHawk around and flew a box around the field. I was really surprised that the KnightHawk could take off in such a short distance without flaps!

When I had the KnightHawk level, I put in three clicks of left aileron trim; that was the only trim change necessary. I made three more circuits of the field and set up for a landing. Because I hadn't tried the flaps yet, I decided to land without them. I lowered the throttle and landed without a bounce, then taxied back to the pit area.

I topped off the fuel tank, increased the elevator throw slightly and went back up again. The Knight Hawk proved that the first takeoff wasn't a fluke. The plane looped from level flight, had a moderate roll rate and didn't exhibit any bad characteristics.

(Continued on page 126)

NAME THAT PLANE

CAN YOU IDENTIFY THIS AIRCRAFT?

If so, send your answer to *Model Airplane News*, **Name That Plane Contest** (state issue in which plane appeared), 251 Danbury Rd., Wilton, CT 06897.

CONGRATULATIONS to James Patten of Urbana, OH, for correctly identifying the December '93 mystery plane—the Douglas 8A-5 attack bomber. Designed by the famous aeronautical designer Jack Northrop, the plane was named the "Northrop 2E" attack bomber. When Donald Douglas purchased Northrop's interests, the 2E design was acquired; it emerged later as the Douglas 8A attack bomber. The 8A-5 was the most advanced version.

It had a wingspan of 47 feet, 9.25 inches and was 32 feet, 7.5 inches long. The 8A-5 had an empty weight of 5,348 pounds and a useful load of 2,320 pounds. The aircraft was armed with one .30- and one .50-caliber machine gun in each wing panel and a single .30-caliber machine gun for the rear gunner. A retractable enclosure with a forward-facing glass section that was directly below the rear gunner's station provided a "bombing window" for bombing observation. In addition to carrying externally mounted bombs, the area between the forward and rear canopies housed four rows of twelve 25-pound bombs that were dropped through self-closing chutes. ■

The winner will be drawn four weeks following publication from correct answers received (on a postcard delivered by U.S. Mail), and will receive a free one-year subscription to **Model Airplane News**. If already a subscriber, the winner will receive a free one-year extension of his subscription.

KNIGHTHAWK

(Continued from page 125)

CONCLUSION

The U.S. Aircore KnightHawk is a stable, solid workhorse of a plane. It has predictable flight characteristics and is as tough as two-day-old steak.

The capability to strap any number of things to the bottom of the plane is unique. This is a plane that will lead a pilot to experiment. I recommend it to jaded pilots who are looking for something different. They won't be bored.

**Here are the addresses of the companies mentioned in this article:*
U.S. Aircore, *4576 Claire Chennault, Hangar 7, Dallas, TX 75248.*
Black Baron; *distributed by Coverite, 420 Babylon Rd., Horsham, PA 19044.*
EZ; *distributed by Hobby Shack, 18480 Bandilier Cir., Fountain Valley, CA 92728.*
Fox Mfg. Co., *5305 Towson Ave., Ft. Smith, AR 72901.*
Futaba Corp. of America, *4 Studebaker, Irvine, CA 92718.*
Sullivan Products; *distributed by Swenson Specialties, P.O. Box 663, 2895 Estates Ave., Pinole, CA 94564.* ■

GOLDEN AGE

(Continued from page 113)

Still on the Senior theme is a report from Colin McKinley of Winston-Salem, NC, who provided a photo of his recently completed LW Senior. Built from Bill Weaver plans, Colin powered it with a geared Astro 25 electric using 14 1400mAh cells. Keeping with the OT theme, the control is a 3-channel Pro-Line. Its flying weight is 5½ pounds, probably the same as the prototype. He says that it flies well with realistic OT R/C performance. You might like to know that the original Senior was orange with black trim and silver windows.

SOCIETY OF ANTIQUE MODELERS

Technically speaking, I suppose we can't associate SAM-style R/C-assisted OT free flights with OT R/C, but I see a hidden connection that makes news of them interesting at times. For example, the free flights involved are much older than R/C models. Plus, many early R/Cs were nothing more than converted free flights. 'Nuff said? *Model Airplane News* published my '38 "Blitzkrieg" free-flight design, and some of the SAM people have provided input on it. Perhaps you're attracted to this phase of our sport, so the photos are included. A.J. Johnson of Keller, TX, had some success with the original-size Blitz, so he scaled it up to what appears to be a 7- or 8-foot span. He reports that it outperforms its mother. On the other extreme, John Scott of Detroit has a ½A-size Blitz that's also said to perform well.

That's it for this time. See you next month! ■

VIDEO VIEWS

(Continued from page 120)

than this to design a successful installation! Little hints abound, such as putting pushrod exit holes above surfaces so water doesn't splash into them and how to design water rudders that don't pick up weeds. Things that only someone who has been doing it for a while, and doing it well, would know about.

The tape cleverly alternates building steps with detailed video examinations of completed models and action shots on and above the water. Some fascinating models are shown—sport, aerobatic, scale and just weird, like the triple-finned Whiplash that uses the whole wing as a float.

Though we see how to build a Sullivan float, many non-Sullivan floats are also shown in use. This is no advertisement disguised as a video; in fact, there is no overt advertising at all, but the goodwill and knowledge Sullivan exudes is more than enough to make the viewer believe in his products. I do wish he had worn gloves when working with fiberglass and epoxy, and some of the shots show people reaching over props to remove glow-plug leads or tweak needle valves. If you're careless often enough, an accident will find you.

This is one heck of a good tape about floats and float flying and has more hints and tricks of the trade than most. If you fly off water, or want to, it is highly recommended, but any flier will enjoy it. ■

CLUB OF THE MONTH

PROP NUT
A MONTHLY PUBLICATION OF THE AMPS

ARIZONA MODEL PILOTS SOCIETY

P.O. Box 10843, Glendale, AZ 85318

THE ARIZONA MODEL Pilots Society's November *Prop Nut* newsletter contains interesting and impressive news, such as a short report by Greg Frohreich regarding his trip to Nötsch, Austria. Greg was there to help fellow club member Tony Frackowiak compete in the '93 Aerobatics World Championships. Incidentally, this club's team came in second in the team competition. Greg mentions that the participants came from all over the world, and he finds it amazing that, despite the differences in background and culture, all the modelers had one thing in common—a love of model airplanes.

The newsletter also features the usual "Meeting Minutes," an upcoming events and birthdays calendar, a brain teaser and, to add some spice, a vintage ad of the Dartmouth-Tex full-scale covering fabric, circa November 1933. To reinforce just how old this ad is, there's an interesting footnote that says, "The Curtiss 'Condor,' which Admiral Byrd is taking to the South Pole, is covered with Dartmouth-Tex."

In a great spirit of giving, the club held its fifth annual Toys for Tots Fun Fly in December. Under the supervision of Jan Wortz, the club members donated gifts to the Child Protective Services in Phoenix. This organization provides temporary housing for children who are experiencing domestic problems, and the donated toys were given to the children who were under their care during the holiday season. This is a great way to show these kids the true spirit of the holidays! Perhaps other clubs will follow suit.

Congratulations to the Arizona Model Pilots Society! We hope you enjoy your two complimentary subscriptions to *Model Airplane News*. ■

HOBBY SHOP DIRECTORY

Retailers: Make your business grow with new traffic! Now you can advertise your hobby shop in the ***Model Airplane News* Hobby Shop Directory**. The listing will be published monthly and will be listed according to city and state. You have 3 to 4 lines, approximately 20 words, in which to deliver your sales message, plus space for your store's name, address and telephone number.

HOBBY SHOP DIRECTORY SPACE RATE
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Space reservations must be received by the 10th of the third month preceding publication (for example, January 10th for the April issue).

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Fax: 55-031-4615501 [9/94]

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[8/94]

Send sales message and payment to:
Model Airplane News, Hobby Shop Directory,
251 Danbury Rd., Wilton, CT 06897.
For more information, call toll-free (800) 243-6685 and ask for Arlene Melko.

CLASSIFIEDS

RATES: non-commercial—25 cents per word. No charge for name and address (no commercial ads of any kind accepted at this rate); commercial— 50 cents per word (applies to retailers, manufacturers, etc.); count all initials, numbers, name and address, city, state, zip code and phone number. **All ads must be paid for in advance.**
To run your ad for more than one month, multiply your payment by the number of months you want it to run. Deadline: the 10th day of the month, 3 months in advance e.g., January 10 for the April issue. We don't furnish box numbers, and it isn't our policy to send tear sheets. **SEND AD AND PAYMENT TO: CLASSIFIED ADS, Model Airplane News, 251 Danbury Rd., Wilton, CT 06897.**

R/C WORLD ORLANDO, FL, CONDO RENTAL: 2 bedroom, furnished. Available weekly or monthly. Low rates. 100-acre flying field with enclosed hangars. Close to Disney World and Epcot Center. For information, please call or write to R/C World, 1302 Stearman Ct., Orlando, FL 32825; (407) 380-6359.

WANTED: model engines and race cars before 1950. Don Blackburn, P.O. Box 15143, Amarillo, TX 79105; (806) 622-1657. [6/94]

WANTED: your old proportional radios; interested in pre-1980, American made; C&S, Deans, Klinetronics Spar and others. *Older is better.* Ron Gwara, 21 Circle Dr., Waverly, NY 14892; (607) 565-7486. [9/94]

WANTED: model-airplane engines and model race cars made before 1950. Jim Clem, 1201 E. 10, P.O. Box 524, Sand Springs, OK 74063; (918) 245-3649. [6/94]

MISSILE SECRETS—engines, rockets, U-build. $2. Northtech-A5, 813 Cherry Ave., Albany, GA 31710

WANTED: old engine parts, misc. junk before 1970. Wesley Pettinger, 1501 Banbury Ct., Richardson, TX 75082; (214) 669-4003. [7/94]

CLEVELAND KITS (AND PLANS) WANTED: Immediate cash, call or ship for offer. Ship to Jay Herbert, P.O. Box 1286, Mattituck, NY 11952; (516) 298-4135; fax (516) 298-4181. [3/94]

ANTIQUE IGNITION AND GLOW PARTS CATALOGUE:100 pages–timers, needle valves, orginal cylinder heads, point sets, drive washers, stacks, spark plugs, plans. Engines: Atwoods, Baby Cyclones, McCoys, Hornets, others. $8 post-paid, U.S.; $20, foreign. Chris Rossbach, R.D. 1 Queensboro Manor, Box 390, Gloversville, NY 12078. [8/94]

NEW ZEALAND AERO PRODUCTS—Scale plans: Agwagon, Pawnee, Pawnee Brave, Airtruk/Skyfarmer, Fletcher FU-24, Aerobat, Hall's Springfield Bulldog, Typhoon, DC-3/C-47, Fairchild PT-19/Fleet PT-26 and more. Fiberglass parts; hardware packs; timber packs; color photo packs available. Free documentation with plans. Catalogue/price list: $5 (U.S.); Visa/MC. 34 Ward Parade, Stirling Point, Bluff, New Zealand; (03) 212-8192. [2/95]

PARACHUTIST! Release a scale-like parachutist! A real crowd pleaser and a lot of fun! For a brochure and jump contest rules, SASE: Hobby Hut Mfg., 2040 W. 21st St. N., Suite #77, Dept. MAN, Wichita, KS 67203 [3/94]

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WRENCHES AND GASKETS for vintage and newer engines Bob McCord 325 Sylvan Mountain View, CA 94041. [3/94]

SCALE DOCUMENTATION-MODEL PLANS—Drawings, photo packs, monographs, unusual aircraft. Illustrated catalogue: $2 (post-paid). Bill Young, 8106 Teesdale, N. Hollywood, CA 91605. [4/94]

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ANTIQUE AIRPLANE PRINTS*. 8x10 color prints.* Stearman, Gee Bee, Waco, Jenny, P.T. Ryan; 10 in all. Send $1 (refundable) for color brochure. Robert Kohr, P.O. Box 204, York, PA 17405. [5/94]

SALE—kits: wood, plastic; ignition engines; parts and mags (pre-1965). *Specify needs. Send SASE and 60 cents for list. Leonard Roberts,* 3819 Lydon Ln., Moosic, PA 18507; (717) 961-2357. [12/94]

PAYING $50 each for toy metal outboard boat motors. Oliver, Evinrude, Johnson, Gale, Wen-Mac, Sea Fury, etc. Richard Gronowski, 140 N. Garfield Ave., Traverse City, MI 49684; (616) 941-2111. [5/94]

CUSTOM KIT BUILDING. Will build most kits from trainers to quarter scale; 20 years experience. Write for quotes: Midwest Model Factory, 280060 Highland Rd., Minatare, NE 69356. [5/94]

WANTED: built or partially built Ercoupes, Cessna 150, 152, 172, 182, Grumman American Tiger (AA5), American Yankee (AA1), or Mooney M-10 Cadet. Glen Mills, P.O. Box 3393, Mission Viejo, CA 92690; (714) 768-0585. [11/94]

PLANS ENLARGED. Scanning/plotting services; model designer's computer software; free information. Concept, P.O. Box 669E, Poway, CA 92074-0669; (619) 486-2464.

MAKE REAL DECALS with your computer and printer! Send $10 for *starter kit and instructions to* LABCO, 27563 Dover, Warren, MI 48093-4764. [5/94]

GIANT-SCALE PLANS by Hostetler. Send SASE to Wendell Hostetler's Plans, 1041 B Heatherwood, Orrville, OH 44667. [11/94]

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ENGINES: IGNITION, GLOW, DIESEL—new, used, collectors, runners. Sell, trade, buy. Send $3 for huge list to Rob Eierman, 504 Las Posas, Ridgecrest, CA 93555; (619) 375-5537. [5/94]

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MODEL MOTORS WANTED—Most types, 1970 and earlier. Cash or trade. T. Crouss, 100 Smyrna, West Springfield, MA 01089. [3/94]

FOR SALE: Ignition engines, all pre-1950. Send large SASE: Leonard Roberts, 3819 Lydon Lane, Moosic, PA 18507; (717) 961-2357. [3/94]

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FOUR 1993 SCALE CATALOGUES—SPPS super-scale plans, SPPS scale handbook, ASP aircraft drawings handbook (three-views). Catalogues—$5 each. Overseas airmail—add $5, 1 to 4 catalogues; 140 *different scale plans; 120,000 photos.* Visa/MC. Jim Pepino's Scale Plans and Photo Service, 3209 Madison Ave., Greensboro, NC 27403; (919) 292-5239. [4/94]

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WANTED TO BUY: original kit form, circa 1968 to 1970, "Schoolgirl" by Top Flight. Barbara Blythe, 2227 N. Fremont St., Monterey, CA 93940; (408) 372-7586. [4/94]

NEW TO RC?—booklet: "Selecting, Building, Flying Your *First* Radio Model"—$4, including postage. Dr. Little, #1 E. University Pkwy., #209, Baltimore, MD 21218. [5/94]

WANTED: *Sterling discontinued Ansaldo SVA5 kit no. A-18; Spad XIII kit* no. A-21; Guillow's discontinued Pfaltz D-3 kit. Collector will pay top prices. George Santikian, 7285 N. Channing, Fresno, CA 93711; (209) 439-3363. [5/94]

PLANS WANTED: *originals from '30s, '40s, '50s and '60s; model airplane* kits; CL, FF and rubber-powered. Jim Wesch, RR 3, Box 76, Centerville, IA 52544. [4/94]

R/C SKYDIVING—illustrated catalogue: $1. R/C Skydivers, Box 662N, St. *Croix Falls,* WI 54024. [7/94]

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PROMOTION—free biplane sport-scale plans. Send address: Sibille Concept, 272 Royal, Gatineau, Quebec, Canada J8T 8E5. [4/94]

FOR SALE: Avons F-15 kit—new; in box: $450; R/C kits F7 Tigercat. Call (314) 843-7126. [3/94]

FOR SALE: Airtronics VG4R-FM transmitter, channel 51, with Ni-Cds and charger, NIB. *Graham Thomson, 1303 Avenida De Cortez, Pacific* Palisades, CA 90272; (310) 459-1804. [3/94]

MODEL HOT-AIR BALLOONS. Fly thousands of feet high; visible for miles at night; build for pennies each. Photo-illustrated instructions. Send $5 to Air-Crafts, Dept. B, 62 S. Gate Dr., Poughkeepsie, NY 12601. [5/94]

BALL BEARINGS—now! Full-time bearing service. Bearings in stock to fit most model engines, steel, phenolic, or polymide. Installation available. UPS service; SASE for price list: Revmor, P.O. Box 548, Palm City, FL 34990; (407) 283-6831. [5/94]

ENGINE STARTER—for model airplanes; ingenious design. Construct with inexpensive materials in minutes. Plans—$2. Send to: 367 Grapevine Dr., Diamond Bar, CA 91765. [3/94]

FOR SALE: B-24D Liberator. Jack Stafford model "Strawberry Bitch"; complete kit—$300. Christopher Hawkins, 7616 Barnowl Trail, Orlando, FL 32810; (407) 293-2088. [3/94]

CONCEPT-30, *SX upgrades, X-Cell Skids, OS32F, JR-MAX6 PCM* programmable radio, Kyosho Jet Ranger fuselage kit, plus extras. Package for $700, or best offer. Tim Pritchett, 244 Georgia Queen Dr., Woodruff, SC 29388; (803) 439-6571. [3/94]

ANTIQUE IGNITION engine parts: *excellent reproductions, fuel tanks,* points, timers, coils, needle valves, gaskets, etc. Champion spark plugs. Catalogue—$5 (intl. airmail—$7). Aero-Electric, 1301 W. Lafayette St., Sturgis, MI 49091. [8/94]

WANTED: *ignition model engines 1930s to 1950s, especially Elf,* Baby Cyclone, Brown Jr., Ohlsson Custom and Gold Seal. Also model racecars, any parts, spark plugs, etc.; Woody Bartelt, 1301 W. Lafayette St., Sturgis, MI 49091; (616) 665-9693, or (800) 982-5464. [8/94]

WW I SCALE PLANS: *sub-peanut to 100 inches. Send $1 for illustrated* catalogue: Smileys, 23 Riverbend, Newmarket, NH 03857. [7/94]

WANTED: TOY BOAT MOTORS—outboard; metal; paying $100 each for: 35hp Oliver, 100hp Mercury. Paying $75 each for: 35 and 60hp Gales, 40 and 75hp Evinrudes, 40 and 75hp Johnsons, 40, 60, 70, 80hp Mercurys. Paying $50 each for all other Johnsons, Mercurys, Scotts, Evinrudes. Also buying gas-powered 1- and 2-cylinder Sea Furys, generic motors such as Imp, Cyclone, Tornado, etc., and 10- to 18-inch-long wooden model boats. If you have the original box, add 10 percent to these prices. Richard J. Gronowski, 140 N. Garfield Ave., Traverse City, MI 49684-2802; (616) 941-2111. [3/94]

LOCKHEED P-38 LIGHTNING. If P-38s—R/C scale models or full size—are your *thing,* join the P-38 Model Organization International—a world-wide *association for P-38 enthusiasts. For more information, send $1 to* P-38 M.O.I. Medelbyvej 54 DK 2610 Rodovre, Copenhagen, Denmark.

PC PERFORMANCE: easy-to-use, menu-driven computer program predicts flight performance of R/C model aircraft. For IBM PC compatibles with *monochrome or color-graphics capability. Introductory price—$15 (plus* $3 S&H). Specify disk format. Softair, 10710 Evergreen Way #D305, Everett, WA 98204. [5/94]

SOFT XMITR control-stick pads. Custom look, non-slip covers—feel *comfortable. For information, send SASE to Amertech,* P.O. Box 9233, Wichita, KS 67277. [5/94]

SCALE DOCUMENTATION and resource guide. Larger, updated 1994 Edition. World's largest commercial aircraft collection. Over 5,000 different *color FOTO-PAAKS and 25,000 three-view drawings; 152-page resource* guide/catalogue—$6 (Canada—$7; foreign—$12). Bob Banka's Scale Model Research, 3114 Yukon Ave., Costa Mesa, CA 92626; (714) 979-8058. [8/94]

INTERNATIONAL AIRCRAFT RESEARCH: *need documentation? Include* name of aircraft for availability of documentation, with $3 for photo and three-view catalogue. 1447 Helm Ct., Mississauga, Ontario, Canada L5J 3G3. [9/94]

AIRWAVES

(Continued from page 34)

stands by his review, and the portions we reviewed (the tapes span seven hours) convinced us his comments were on the mark. But that's not to say reasonable people can't disagree about a product like this, either. From my own conversations with Silicon Valley, I know that the producers of the tape made an earnest effort to break new ground and to help fledgling R/C'ers. We just felt this first edition fell short. TA

BYRON SUKHOI AILERON SERVOS

In my December '92 field and bench review of the big Byron Originals Sukhoi, a photo shows that I installed the aileron servos on the top surface of the Sukhoi's wings. Since the kit instructions place the aileron servos on the bottom, Byron, as well as some readers, have asked me why I placed the aileron servos on top.

I fly at a field that grows corn and hay. Any landing off the field rips the landing gear off any aircraft. The larger and heavier aircraft fare worse than others. I felt that the exposed output arms, pushrod and control horn would be short-lived after any landing in the tall stuff.

After Byron issued the anti-flutter kit (owing to incidents reported to them by some of their early customers), I decided to keep the pushrods and associated linkage visible on the top of the wing. This allows me to check the integrity of the control-horn base as well as the servo mounting after each flight with minimal fuss.

My reasons are matters of personal preference and are not intended to be a recommendation that others modify the aileron installation. Notably, I have not made this modification on the Byron Sukhoi alone; all my aircraft are configured this way.

DAVID C. BARON

Contributing editor, columnist and test pilot
Model Airplane News

ADVERTISER INDEX